

THE FLYING CANNONEERS

# POPULAR MECHANICS MAGAZINE



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armament  
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**"Don't tell the General... but I helped put  
his army on synthetic rubber tires!"**

**"It all began back home  
before the war, with a  
road test that totaled  
80,000,000 miles"**

"Here's what I mean," said the P.F.C. "The tires I drove in the test were the *ancestors* of the ones on this buggy. The B. F. Goodrich Company wanted to prove that synthetic rubber would work in passenger tires. So they sold several thousand tires, and asked people to send in mileage reports. All together we rolled up 80,000,000 miles, and that's a lot of miles."

The passenger car tires used had more than 50% of their natural rubber replaced by our own synthetic—Ameripol. Today's all-synthetic passenger car tires are made with government synthetic—"GR-S." And 99% of the natural rubber has been replaced by it.

That pre-Pearl Harbor test gave us a 3-year head start. It gave us the "know how" that has already enabled us to produce a synthetic passenger car tire *almost* as good as the Silvertowns you used to get! It's easily the best synthetic tire you can buy today.

*There are some synthetic tires today available to those who can qualify. But our fighting forces still need every ounce of rubber they can get. So do everything you can to make your present tires last—don't drive even one unnecessary mile.*

The B. F. Goodrich Company, Akron, Ohio

*In war or peace*

**B.F. Goodrich**

This One



8S3J-DRR-Z17J



1A



Awards to  
9 plants

MARCH, 1944



# A NEW RESOURCE HAS BEEN DEVELOPED

---

THE wealth of America has been wrought from her natural resources of fertile lands, wide forests and rich mineral deposits by the brains and muscles of her people.

But another resource is now available. A new source of wealth and well-being has been developing gradually and almost unnoticed which is tremendously important today and of still greater importance for tomorrow.

This new resource is the research laboratory.

Today, in hundreds of industrial and college laboratories, trained minds are expanding the world's knowledge, and applying the results of research to industry and to war.

In the Bell System, research has always been a fundamental activity. The telephone was in-

vented in a research laboratory. And for years Bell Telephone Laboratories has been the largest industrial laboratory in the world.

Underlying modern research is the realization of vast latent values in nature. Although the lone genius does from time to time bring to light some part of these hidden values, only organized scientific research can assure the thorough exploration that will render the full measure of use for human welfare.

Research means imagining and experimenting. It means the searching out and bringing together of facts. It means clear statements of problems, precise measurements and keen analysis. It means tenacious following along unexpected paths.

These are the procedures of research. Its consummation is the



grasping by subtle minds of relationships in nature no one has previously known. And on the basis of the broader knowledge so established are built new materials, new methods and new structures to serve the people of America.

The Bell Telephone Laboratories has now concentrated its efforts on communication systems and equipment for the armed forces. When the war is over its researches in communication will again be applied to an ever-improving telephone service in America.

BELL TELEPHONE SYSTEM





# Popular Mechanics Magazine

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H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

March, 1944

Vol. 81, No. 3

## Next Month

UPON the smallest thing known in nature, American scientists have built a \$4,000,000,000 a year industry. It would take more than 30 octillion electrons to tip the scale at one ounce, yet electrons have emerged in the last few years from the unknown and mysterious into universal usefulness. The electronic tube, a gate controlling the flow of power, might well be the Aladdin's lamp of modern industrial magic—"The Tube That Is Remaking the World," as it is called in an article featured in the April issue. Here in simple terms you'll find the story of electronics and its magic promises.

## The Navy's Tools

WHAT does the Navy fight with? The armored 16-inch gun turrets of a battleship weigh as much as a whole destroyer. Its armor may be thicker than the diameter of the 16-inch shell it must resist. One American vessel took a bomb hit on top of a turret, and the only repair equipment needed was a paintbrush, the only injury a scratched ear. Rear Admiral W. H. P. Blandy, Chief of the Navy Bureau of Ordnance, tells of "The Navy's Tools of War" next month.

## Flak, Unlimited

HITTING an airplane is about as easy as knocking down a bumblebee across the street with a peashooter. Nevertheless our antiaircraft gunners are knocking 'em down. An electric brain aims our 40-millimeter gun, electric muscles swing its barrel toward the fast-moving target, automaton gunners fire it by remote control. Read "Flak, Unlimited" in April.

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## New Magic in Black Gold

TWO years after the war some of the epochal wartime discoveries of the petroleum industry may be made available to you. Most of them are military secrets today, but it is no secret that they are talking of 50-miles-per-gallon gasoline and 100,000-mile tires. An April feature tells of some of the research in the Shell Development Company laboratories, where they study petroleum under infrared, ultraviolet and X-rays, whirl it in a super-centrifuge powerful enough to drive the copper out of brass, and distill it at 1/1,000,000th the pressure of the atmosphere. Look for "New Magic in Black Gold."

## How to Come Back Alive

FROM Main Street, U. S. A. to a rubber raft in mid-ocean or a South Seas jungle is quite a social revolution, but the Yankees are inventing ways to "Bring Themselves Back Alive." The story of their ingenuity in our next issue tells of one pilot who parachuted into the midst of savage tribesmen just finishing a meal of two Jap flyers. He talked himself out of that and eventually sailed into an American base in a war canoe like an island potentate.

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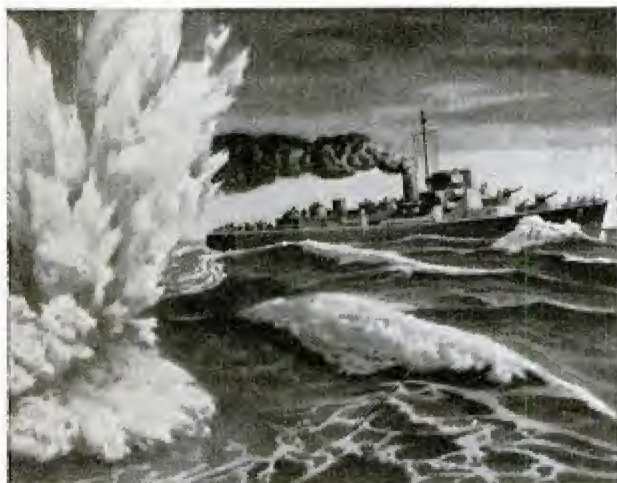
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## On Land!

Defoe is now building 1700-ton Navy Destroyer-Escort ships—the *largest* warships ever launched on the Great Lakes. Through its unique "roll-over" process, Defoe is able to deliver *twice the production per man hour*, resulting in double the number of ships built at *half the labor cost per vessel*! And all without a dollar of government financing.



## On Sea!

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## In The Air!

The Navy "E" with three White Star Renewal Citations flies from the Defoe flagstaff . . . along with the treasury department's special Bull's-eye flag awarded because Defoe employees regularly take more than 10% of their pay in War Bonds. And when Peace returns, the experience and ingenuity of this organization will play an important part in building new and better products for America.

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# Defoe



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<b>IMPORTANT NOTICE</b>	
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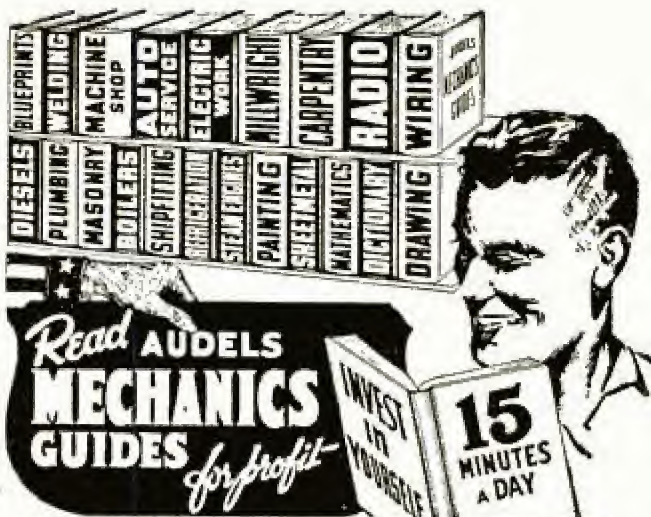
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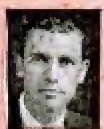


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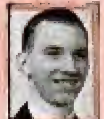
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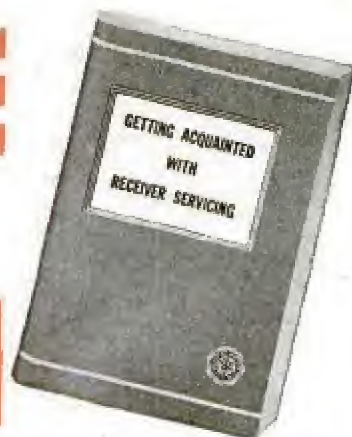
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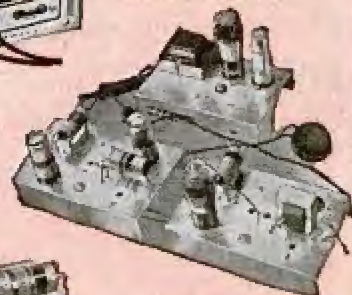
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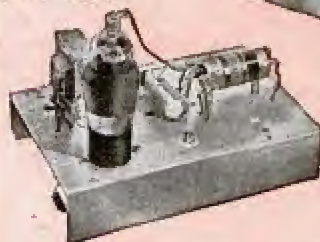
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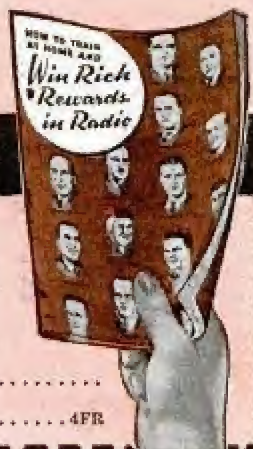
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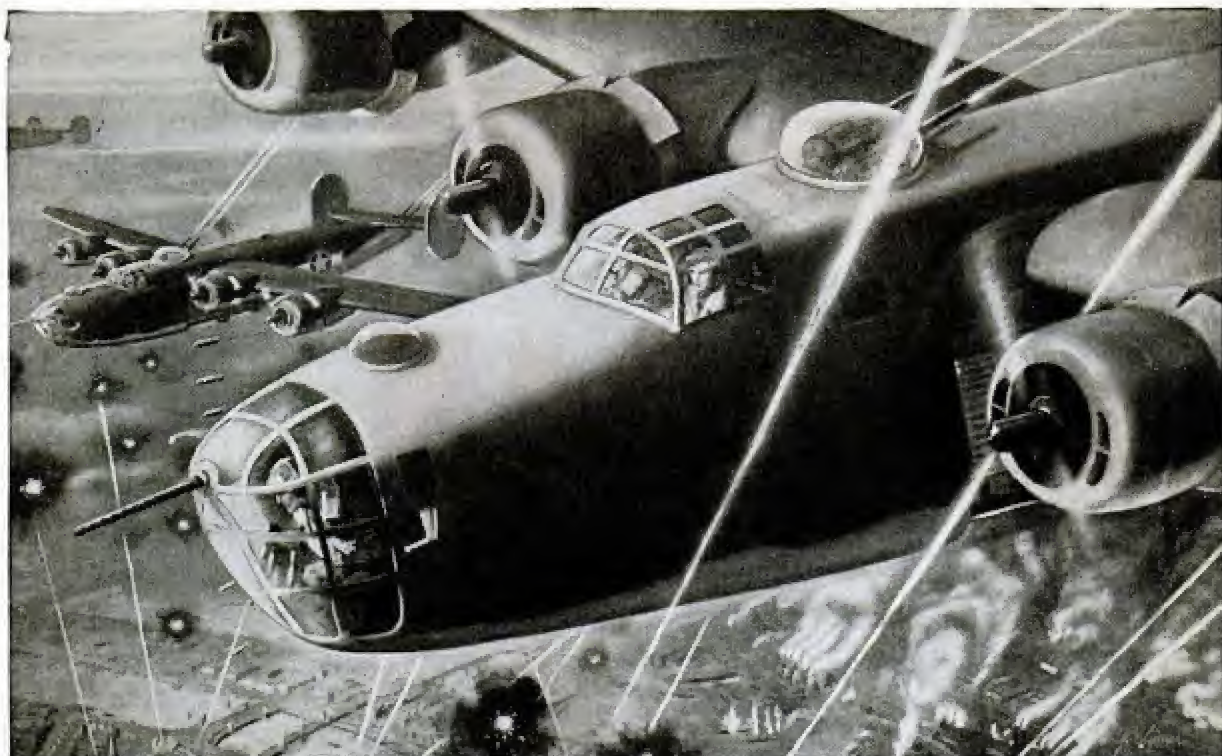
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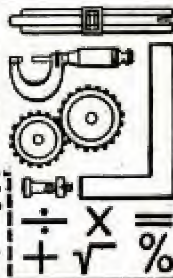
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I don't care how old or young you are or how ashamed of your present physical condition you may be. If you can simply raise your arm and flex it I can add SOLID MUSCLE to your biceps—yes, on each arm—in double-quick time! Only 15 minutes a day—right in your own home—is all the time I ask of you! And there's no cost if I fail.

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No "ifs," "ands" or "maybes." Just tell me where you want handsome powerful muscles. Are you fat and flabby? Or skinny and gawky? Are you short-winded, peepless? Do you hold back and let others walk off with the prettiest girls, best jobs, etc.? Then write for details about "Dynamic Tension" and learn how I can make you a healthy, confident, powerful HE-MAN.

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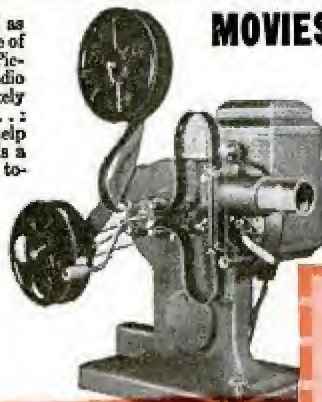
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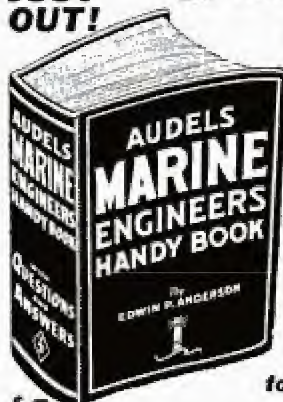
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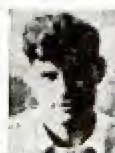


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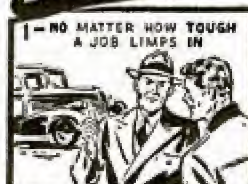
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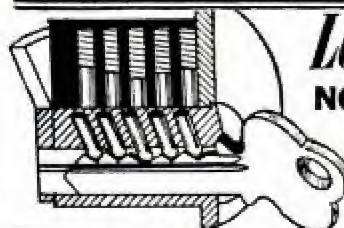
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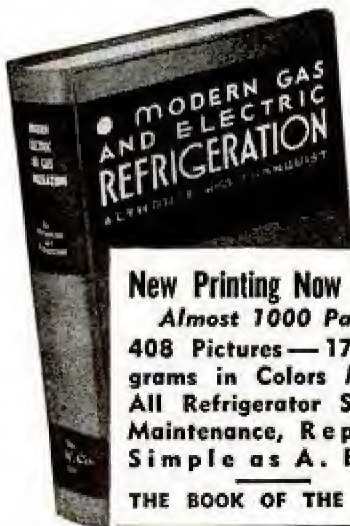


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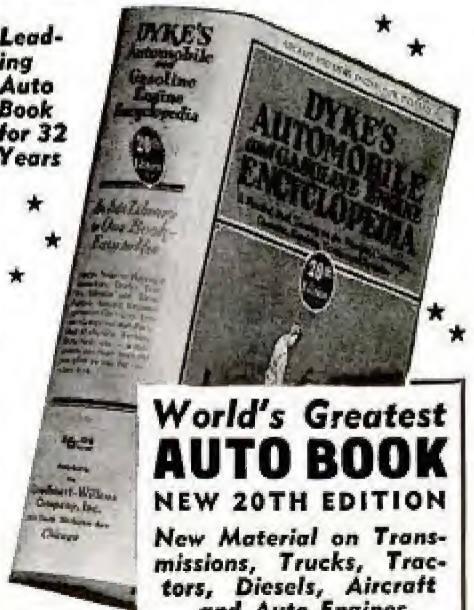


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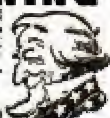
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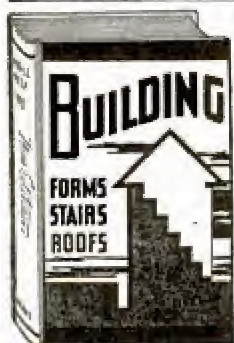
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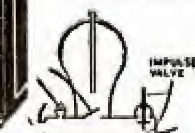
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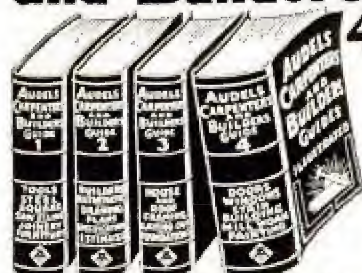
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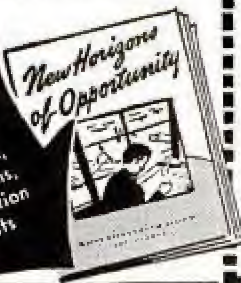


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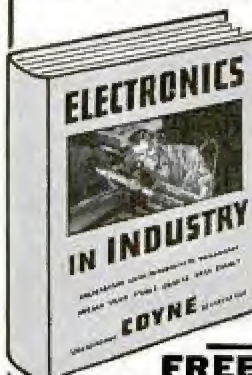
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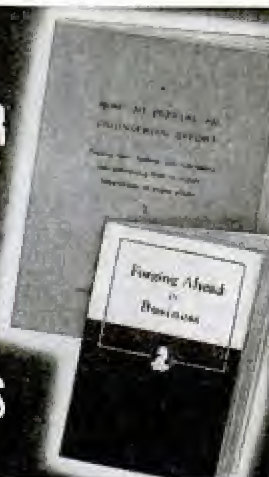
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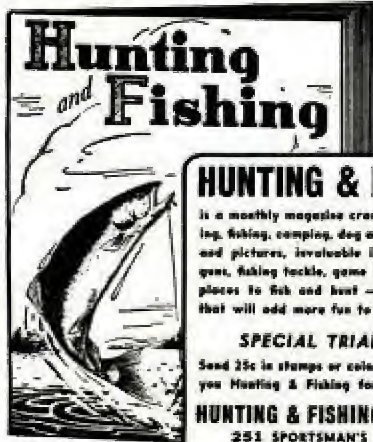
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For the first 200 yards these mysterious shells trail smoke and appear to gain momentum. Then they explode twice as big as flak. Other strange objects beneath the Fortresses burst into incendiary silver stars, and falling from high-flying fighters are deadly missiles exploding in gray puffs.

"Jerry's up to something!"

This time the words are in Russian on the battlefields east of Zhitomir. Across the land speeds an armored object the size of a motorcycle sidecar. In its nose are 150 pounds of TNT.

"Jerry's up to something!"

The same words, but the scene is the deck of a destroyer in mid-Atlantic. Something is moving through the water toward the vessel as if drawn by a magnet. A



The arrow at top points to the 75-millimeter gun in nose of "Mitchell" bomber—the largest weapon ever mounted in airplane. Below, the shell it hurls into enemy ships and planes

MARCH, 1944

1





Six-barreled rocket projectors captured from Nazis intrigue U. S. troops

moment later there is a terrific explosion and another secret weapon has made its first appearance in the war.

But don't get the idea that all the surprise weapons are German, as Axis propaganda would have you believe. New weapons that are effective, particularly Allied weapons, are usually introduced in combat and not over the radio.

An example of this was the recent precision bombing of Berlin on a cloudy night. It's anybody's guess how the R.A.F. Lancasters did it, but it would have been possible with an electric automatic pilot that could direct a plane within 40 to 60 feet of a predetermined bombing point hundreds

of miles away. Such a pilot might be the answer. Whatever the means, the result was one of the biggest surprise attacks of the war.

There have been secret weapons ever since man first tied a stone on a stick and whacked his fist-fighting enemy over the head. They are the dream of every commander, and World War II has produced more surprise weapons of the air, land and sea than any conflict in history. Some of the surprise weapons were more of a surprise to the civilians than to military brains of the belligerents.

Allied experts, such as Oliver Stewart, the British aviation authority, put Radar at the top of the list of secret weapons having the greatest effect on overall strategy. Following in close order are power-operated gun turrets, antitank weapons, rocket weapons, energized rings on bombers to combat German magnetic mines, and engine developments such as the two-stage supercharger that carry aerial warfare to dizzy heights.

Some of the most effective surprise weapons—the million-candlepower searchlights used on Allied bombers to hunt subs at night—the combat formation used by Liberators and Flying Fortresses to concen-



Cutaway drawing of a German submarine shows how the U-boats plant mines from slotted chambers to harass Allied ships

Newest Allied secret weapon just made public by the AAF and the RAF is a jet propulsion fighter plane—not to be confused with rocket propulsion. Hundreds of successful flights have been made with the propellerless craft at enormous speed and great altitude. First flight in the jet plane, which has a special engine developed by British Group Capt. Frank Whittle, was made in May, 1941. Twin-engined models built by Bell Aircraft were flown in the U. S. Oct. 1, 1941. British newspapers estimated the speed of this "queer looking, weird sounding" plane at 500 to 600 m.p.h. and said it passed a Spitfire like a "racehorse passing a hack"



trate their fire—are the least sensational. On the other hand, rocket bombs, a development in the realm of Buck Rogers, have still to prove their worth in aerial warfare.

Lack of recoil, target penetration, and range are prime factors which for years have spurred on inventors in their efforts to harness rockets. With rocket bombs, the Germans claim they are the first to develop an effective rocket weapon. It is a matter of record that rockets were first launched in this war from tubes under the wings of Russian Stormovik planes. The Germans learned about these rocket projectiles the hard way, for the targets were Nazi tanks. The principal difference between the Russian rockets fired at ground targets and the Nazi anti-bomber rockets is that the former are fired by contact fuses and the latter by time fuses. When a shell bursts 20 or 30 yards from a plane, it may destroy it, depending on where the fragments strike.

The Germans boast that they sank the Italian battleship *Roma* with a "flying bomb" carried on the wings of a rocket-assisted glider directed by remote control. The glider is said to be guided by the bombardier in a "parent plane." This winged torpedo, first described by Prime Minister



This 1,000-pound bomb is a pygmy beside the R.A.F. 4-ton blockbusters

Winston Churchill, may burn powder in its rocket motors or one of the fuels with which German rocket engineers have been experimenting for years. Range, operational detail, and effectiveness are matters of speculation, but experts agree such a weapon exists.

The Nazis have also allowed to "leak" out through neutral sources the existence of giant rocket guns set up along the coast of France to shell London. This "Goebbels' Delight" is said to have a barrel 100 feet long and a range of 125 miles. The projectile, fitted with small wings, steering gear and propulsion apparatus would travel through the stratosphere. Londoners, who

A secret kept three years was this 50-foot electric ring on an R. A. F. bomber, used to explode magnetic mines







One of our own best secrets was the "bazooka," the two-man rocket gun that has stopped tank attacks with its armor-piercing projectile. Here it is ready for action in a well camouflaged position

U. S. Signal Corps photo

propulsion in the takeoff or for acceleration in combat.

Other rocket weapons are the German six-barreled "nebelwerfer," or fog thrower (British soldiers call it the "screaming meemie"), and the famous

believe guns of this type actually have been set up, are not alarmed, for experiments have shown that the barrel would stand no more than 30 shots. Also, the flash of detonation would light up an entire countryside and be quickly spotted by reconnaissance planes.

Another Nazi propaganda favorite is a new type of bomber which is said to have rocket propulsion. Engineers say that if such a bomber exists, it probably uses jet

American bazooka. The latter, which launches a rocket projectile from a hollow tube, has proved its worth as a tank buster. The first Nazis to encounter the bazooka in Africa mistook its fire for a 155-mm. gun.

While the Russians and Germans appear to lead in the development of rocket weapons, it can be told that American and British engineers have devoted exhaustive research in this field. Most rocket weapons, however, are better adapted to defensive

strategy, and Allied ingenuity has been bent on offensive weapons such as the M-7 tank destroyer, the super Flying Fortress known as the B-29, torpedo planes, incendiary bullets that explode self-sealing gasoline tanks on aircraft, rifled mortars, rifle grenade thrower which hurls a grenade a distance between those covered by the hand grenade and mortar shell, parachute bombs that can be safely dropped by a low-flying plane, machine guns with increased fire power, ricochet and time shells, bomb sights, and such highly technical developments as the Sperry automatic gun sight.

The Sperry gun sight, which takes the guesswork out of aerial marksmanship, is credited with helping knock down 541 Nazi fighters in a single month. It



Yankees examine a German 32-cm. incendiary rocket captured in Sicily. It is fired directly from crate





Maj. Gen. Levin H. Campbell, Jr., Army Ordnance chief, inspects Jap grenade thrower

Nazi rocket bombs (left) are guided by radio from planes to hit ships (lower right)

calculates the amount of "lead" on a target, the effect of gravity and the wind, points the guns and tells the gunner the precise moment to open fire. So far as is known, the Axis has nothing that even approaches this gun sight.

The Army recently announced another effective gun director. This one is used with antiaircraft guns, and it not only directs the angle of fire, but sets fuses so the shells will explode in the path of an enemy plane.

Since the beginning of the war, the enemy has shown considerable ingenuity in developing deadly torpedoes. The Russians recently reported the Nazis are using a land torpedo operated by remote control. It resembles a small tank, is about the size of a motorcycle sidecar, and has a reel of cable at the rear leading back to an operator. The operator directs the torpedo and explodes it electrically. The Russians have found the best defense is to cut the cable.

For some time, the Germans have been intent on producing a surprise weapon that would destroy Allied naval supremacy. When the submarine, holdover threat from World War I, proved ineffective in stopping convoys, the Nazis tried magnetic torpedoes and mines. The British nullified the mines with the "Wedding Ring Wimpy," an en-

(Continued to page 158)

The M-7 tank destroyer, with 105-mm. howitzer and .50-caliber gun, proved to be one of our best war surprises





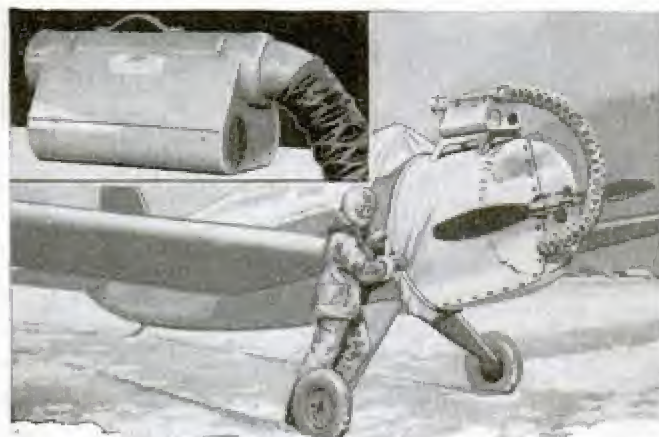
## Winter Mask for Policeman Has Handy Buttoned Flaps



Masks that protect the faces of sailors from icy gales at sea may set the style for traffic officers after the war. The masks, made of water-repellent material, guard against frostbite and shed rain and snow. Buttoned flaps permit the wearer to eat or smoke. As the material for the masks is on priority to the Navy, civilians will have to wait until the war is over before it is available.

## "Suitcase" Preheater for Plane Helps Start Cold Engines

Weighing only 38 pounds, and fitted with a handle grip that enables a man to carry it like a suitcase, a new model engine preheater warmed a 2,000-horsepower air-



6 York Nat. Div. Thos.  
Shipley, Inc., York, Pa.

plane engine from -20 degrees (F.) to starting temperature in 20 minutes. Used in conjunction with a standard engine cover, it pours a blast of warm air directly onto the motor. It produces 90,000 B.T.U. of heat per hour and utilizes 92 percent of all the heat units in the burning gasoline it uses for fuel, operating continuously for about five hours on a three-gallon tank of fuel. Though designed especially to pre-heat warplane engines, the heater has applications to such heavy-duty equipment as snow scrapers, plows, tractors, shovels and similar winter machinery on highways, farms and construction work, where it may speed up cold weather operations.

## Sparks Simulate Racing Horses On Chemical Paper Game

Chemically treated paper "race courses" provide a novel and amusing horse racing game. The sheets of paper are treated so that trains of sparks creep across the surface, at unequal speeds, when a lighted



cigaret is placed at the beginning of the "course." The trail of sparks leads from a "starting line" across the length of the sheet, and hazards are built in by making some of the chemical lines loop and twist, while the others lead straight to the "finish line." The sheets vary, so that it is impossible to predict in advance which of the spark-like "horses" will win.

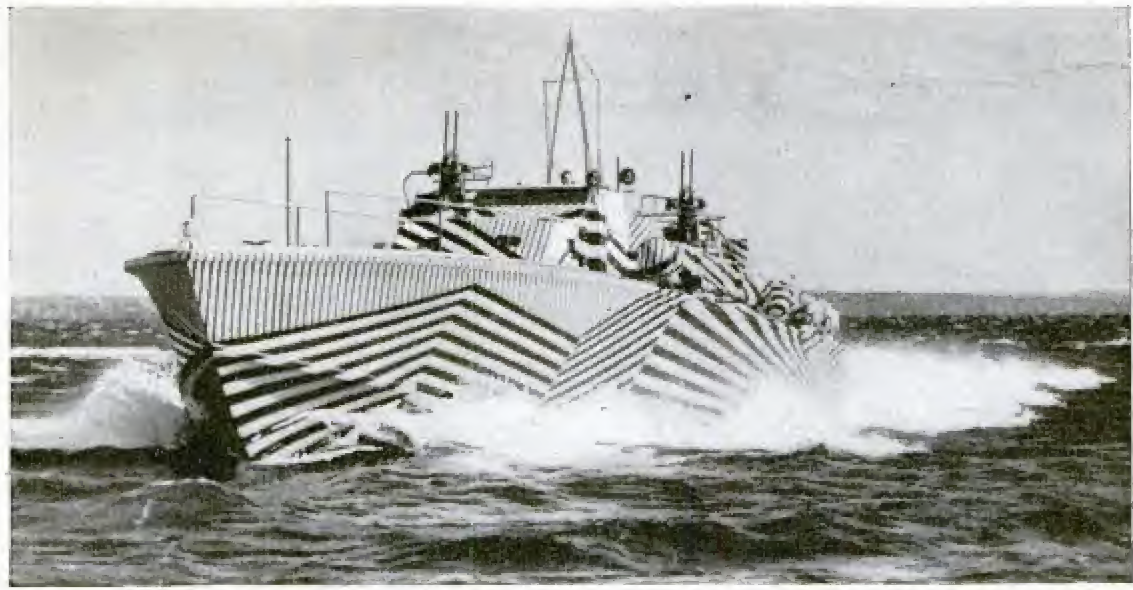
Hot water bottles, ice bags and other articles can be made from flexible plastics that are resistant to oils, soap and water.

POPULAR MECHANICS  
J. W. Hertel Co.  
503 Bank St.  
Kankakee, Ill.



71893

# PT Boat Disguised as Zebra Confuses the Enemy



All dressed up in her zebra stripes, or "convict suit," the Navy's mighty midget, the patrol torpedo boat, is as hard to hit as she is hard-hitting. The new style of cam-

ouflage painting makes the outlines of the craft indistinct, especially at night, when the PT's often operate, and when the craft is churning up spray at high speed.

## Folding 'Para-Bicycle' Dropped in Container

Included in the equipment of paratroopers training in the British Isles are folding motor scooters, which are dropped with the sky soldiers in parachute containers. The collapsible speedsters can readily be lifted by one man, yet they have a speed of about 45 miles an hour and are sturdy enough to support the soldier and his equipment for a jouncing ride over rough terrain. The manner in which such fast, small-sized vehicles contribute to the mobility of paratroop invaders may be readily appreciated.



*Photo from England - no. 2. 21896. known*

## Synthetic Shellac for Metal Is Resistant to Water

Pinch-hitting for natural shellac, a synthetic product called "Zinlac" is said to surpass it in some properties. It will adhere to metal as well as wood, and is resistant to water. The new shellac, developed in the Arthur D. Little Laboratories, Cambridge, Mass., is made from domestic materials. Normally, natural shellac, the hardened secretion of an insect, is imported from India.



MARCH, 1944

*30 Memorial Av.  
Cambridge 42, Mass.*



Thomas E. Stinson, Jr.  
3872 Franklin Ave, Los Angeles 27, Calif.  
N 736

# The WEATHERMAN GOES to WAR



**I**T WAS an odd cargo the C-47 troop transport was releasing over the tropical island. The men leaving the plane by parachute were meteorologists, not paratroopers, and the boxes being dropped by cargo chutes held anemometers and precipitation gages instead of ammunition.

Quite possibly on the same day that this equatorial weather station went into operation another was being set up thousands of miles away in the Arctic where the ground is perpetually frozen and where dank fog and snow make up the usual weather. The Weather Service of the Army's Air Forces operates all over the world.

Few kinds of military information are kept as secret as are weather reports in war zones, and few kinds of information are as "perishable." To be of greatest value the report from a distant station should be not more than an hour old. Weather information 12 hours old is practically ancient history. Only urgent tac-

Through the telescope a meteorologist reads wind direction indicator on mountain top 10 miles away. Below, brushing the snow from a bomber before takeoff from a northern field







Velocity of drifting clouds is estimated by watching movement across wire grid squares

tical orders that might decide the outcome of a battle already under way enjoy priority over weather messages.

Why all this military emphasis on weather? Because weather is a prime factor that must be considered in planning almost any kind of military operation. A flight of bombers may be unable to return to its base if it encounters unexpected headwinds. Warships can hardly make a surprise raid if they enter enemy waters in clear weather. It's the weather man who tells the bomber pilots when they can expect tail winds and who tells the admiral where to find clouds and mist that will hide his movements from the enemy.

It was no accident that Doolittle's flyers had good bombing weather over their targets when they raided Japan. Nor was it simply luck that stormy weather protected our original landings on Guadalcanal. Most such operations are timed to coincide with the kind of weather needed. The Yanks took advantage of anticipated



U. S. Army Air Forces photo  
Releasing radiosonde balloon which will transmit weather data by radio in box until balloon bursts and instrument descends by parachute. Below, barrage balloon carries anemometer to radio reports of wind speeds aloft







Adjusting the tiny radio transmitter of radiosonde balloon; at left is part of aerial weather station. Below, sending up captive balloon to calibrate weather instruments



fog when they landed on Attu, and the Japs used similar fog protection when they sneaked away from Kiska.

When the Germans wanted to move two battleships to safety along the French coast they waited until the weather was perfect for the move. In this case the "perfect" conditions consisted of fog and low clouds, accompanied by rain squalls and

a low icing level. Under these conditions British surface and air craft were unable to stop the get-away.

The officer in charge of a major forecast center is apt to get requests for half a dozen different kinds of weather during the same day. A bombardment squadron may want to know the date of the first afternoon when there will be good cloud cover all the way to a target area, or the request may be for a moonless night with no clouds at all. An armored force general may want to know how long the present dry weather will continue, and an infantry commander may ask for a long range forecast so that he can make his plans. The staff that is laying out a schedule for an amphibious landing wants to know the earliest date at which a low hanging fog and practically no surf can be expected along a certain coast.

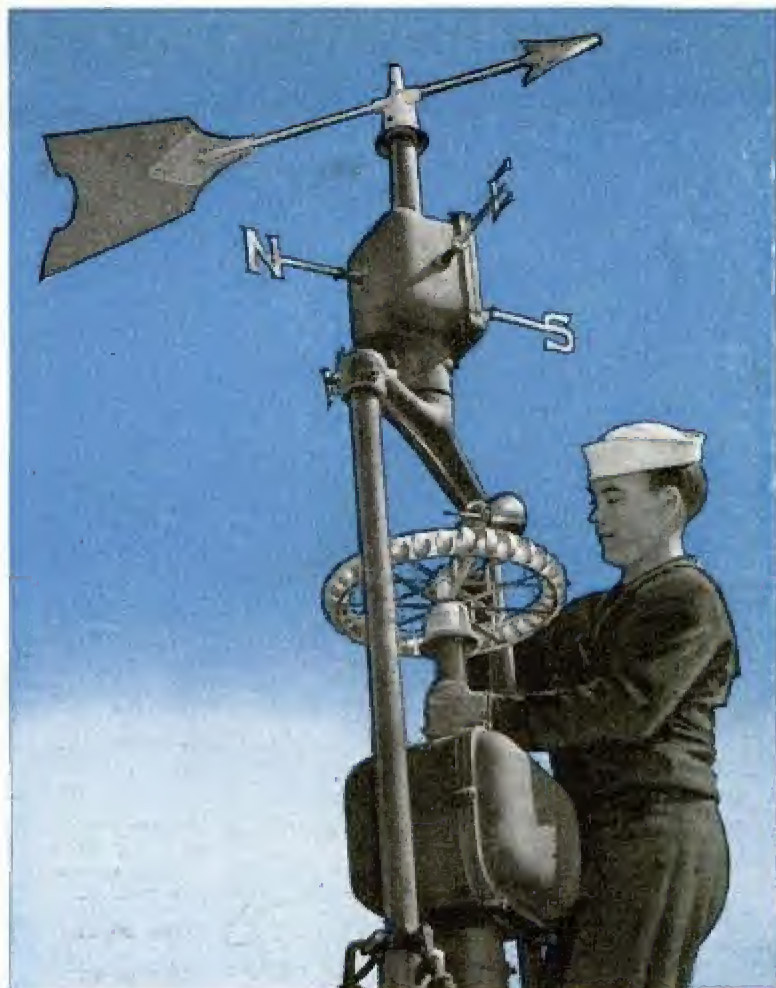
Weather, favorable or unfavorable, can make such a difference in the outcome of



an operation that practically every major move made by either side in this war has been tied in with weather forecasts. Weather usually fights on the side of the attacker. He decides on the time and place, exploiting the weather conditions, while the defender is forced into the fight.

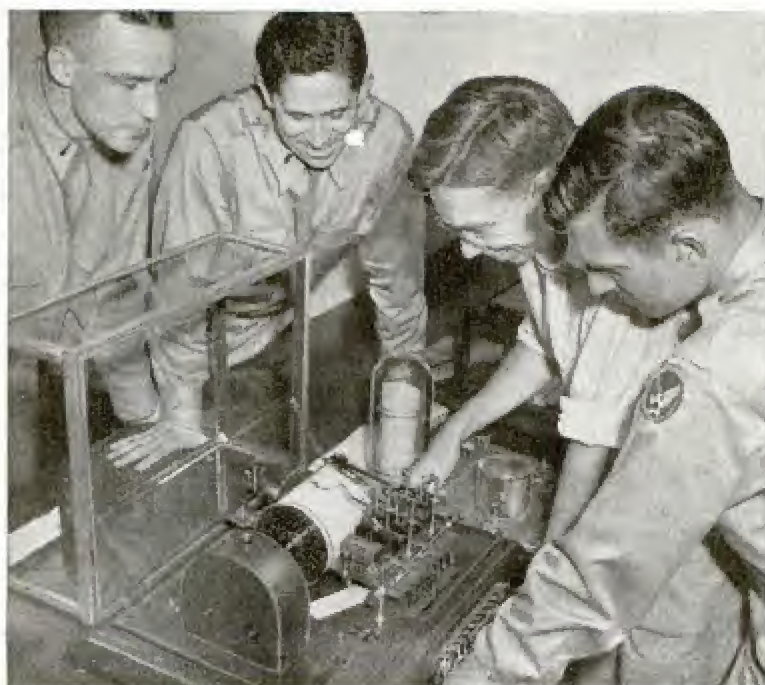
Mistakes in forecasting weather are apt to have disastrous results. The Jap weather men lost their side a fleet of ships and thousands of men by making one bad guess. The Japs had a big convoy ready to move across the Bismarck Sea and they held the ships in port until a storm came along that seemed to be moving in the desired direction. Then the ships started out under the protection of the clouds. Unexpectedly, the storm veered off the course, leaving the ships exposed in the sunlight. Our bomber pilots located them and wiped out the entire fleet.

It was a weather freak, undetected by Allied forecasters in time to



U. S. Navy photo

Wind direction vane and anemometer at Naval station record automatically. Below, recorder of temperature, pressure, humidity and wind velocity



change the schedule, that saved Rommel and his Afrika Korps from what appeared to be certain doom several months before they were finally run out of Africa. General Montgomery had started an encircling movement intended to capture the whole German force and then, just as he was about to spring the trap, heavy rains began. It poured for 48 hours and stalled the British tanks on their tracks. This delay gave Rommel time to flee toward Tunisia.

The crack forecasters of the A.A.F. Weather Service make few boasts about their ability but it is becoming more and more

(Continued to page 156)



## Lip "Mike" for Tankmen Baffles Mechanical Noise



Designed to be worn on the upper lip by men in tanks, and elsewhere in military installations where the user must have his hands free, is a tiny lip microphone which fits readily under gas masks and dust respirators, and eliminates most outside noises to give clear reproduction of the voice. It is produced under Signal Corps supervision. To increase clearness, the microphone is provided with shields in front and back to act as buffers against puffs of air from the mouth that otherwise might cause unintelligible sounds. Outside noises, entering at both the front and rear of the diaphragm in equal volume, cancel each other out, while speech enters the opening nearest the mouth with greater intensity than on the opposite side.

## Non-Vibrating Mounts for Guns Pave Way for Postwar Uses

Vibration—the nightmare of mechanized warfare—has been reduced to a minimum with methods which will be carried over into postwar manufacture. One method, called Silentbloc, eliminates the bonding process of holding rubber to metal by forcing the rubber between two pieces of steel. When guns are firing, or any other disrupting process is taking place, the rubber strives to regain its original shape. The pressure caused in this manner assures a lifetime "bonding." Silentbloc, developed by engineers of the General Tire & Rubber

Co., sustains axial, radial, conical, or torque loads. Postwar uses are predicted in automobiles, tractors, farm machinery, washing machines, printing and textile machinery, and many other mechanized devices.

## "Mosquito Bomb" in Greenhouse Destroys Aphids on Plants

Chemical "bombs," used by the Army to kill mosquitoes and other insects near tents and barracks, will be useful for destroying aphids in greenhouses after the war, according to the U. S. Department of Agriculture. Nicotine, which is deadly for aphids and other pests, dissolves in the freon used in the "mosquito bombs." With the freon as a carrier, only half the usual amount of nicotine is required.

## "Pocketbook" Carriage for Baby Is Canvas Strip With Handles

By converting a substitute wood basket into a substitute baby buggy, one Chicago family solved the baby carriage shortage. The new buggy is a strip of canvas, three feet by two, which when looped over and held by handles forms a basket. A pillow is placed in the "pocketbook" carriage, just as in an ordinary baby buggy. The canvas basket was originally designed as a substitute for copper baskets used to carry wood to fireplaces.





2611 Indiana Ave.  
Chicago 16, Ill.

77812

## "Invasion Radio" Heard Through City's Noise



Mobile radio unit of Signal Corps used in city test to study interference of steel buildings and trolley wires. Below, control board of unit

How high-powered mobile radio stations will stand up when invasion armies enter big, congested European cities was the subject of a test recently in Chicago's downtown shopping district. The test was to determine how the operating efficiency of mobile receivers and transmitters would be affected by the electrical shielding effect of steel buildings, overhead trolley wires, and electric railway lines. While two of the Signal Corps' SCR-299 mobile radio transmitters were set up in operating conditions, another set was maintained inside a department store, and communication was carried on among all three units, with engineers of the Hallicrafters Company, which manufactures the units, as instructors. While the

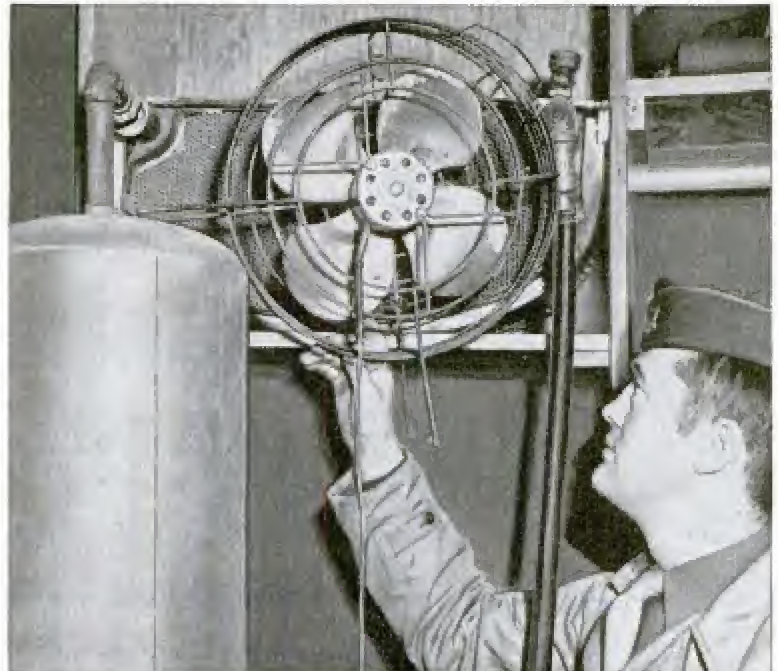


noise level created by street traffic was of high intensity, signals between the units were powerful enough to override the noise and provide uninterrupted communication. Spectators were especially interested in the future possibility of two-way radio communication between autos and homes.

### Hot Auto Radiator Warms Barracks

One group of soldiers solved the problem of keeping their quarters comfortably warm by hooking up a hot-air circulating system out of materials at hand. They connected a thick section of automobile radiator into the upper hot water circuit of an automatic water heater, with a fan placed behind the radiator to blow air through it. The result: warm air in circulation whenever the fan is turned on.

☛ Eyelashes usually do not turn gray with age, according to the Better Vision Institute.





# HEAVYWEIGHT SLUGGERS GUARD



With the Nazi Navy bottled up and the Japanese preoccupied with defense of their beleaguered islands in mid-Pacific, our shores are relatively secure. Nevertheless there is no slackening of the alert coastal defenses, as these gunners demonstrate in night and day drills. At upper left, a 16-inch shell slides into the breech of a big coast gun as another on the hoist moves into position for reloading. At left center, soldiers "on the double" approach a camouflaged 14-inch coast defense gun through a simulated gas attack. The projectiles in foreground weigh 1,400 pounds, with a 400-pound powder charge that sends a shell over 30 miles



The loader above rams a six-inch shell into breech; behind it will go the propelling charge of powder. Left, 16-inch railway gun with one shell loaded, another on hoist, third on carrier below



# OUR COASTS

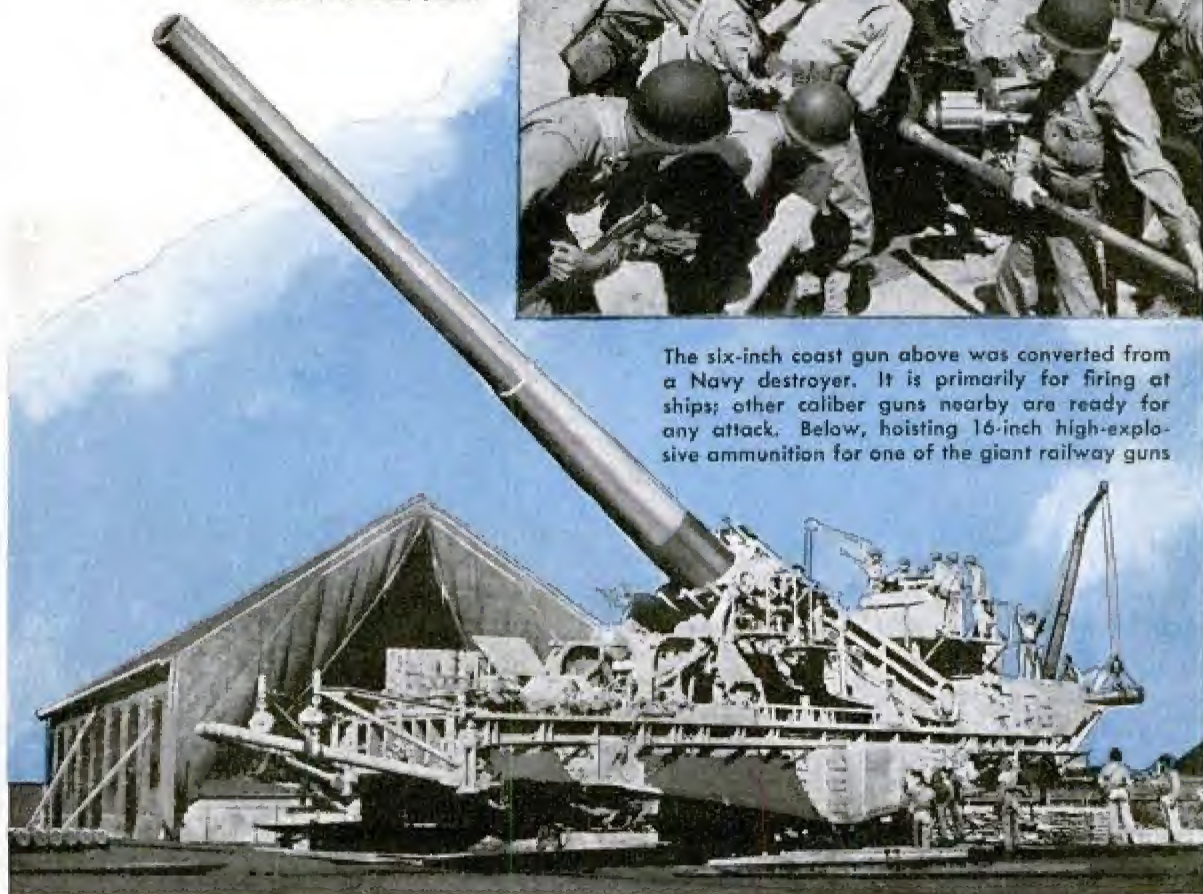


The 14-inch mortars (above) which supplement the big coast guns are used for short-range firing at enemy ships off shore. A battery of six mortars is located close together in a well protected position, with a crew of about 20 men to each mortar. At upper right, range finder on a 14-inch disappearing coast defense gun at Fort MacArthur, Calif.

Official U. S. Army photos



The six-inch coast gun above was converted from a Navy destroyer. It is primarily for firing at ships; other caliber guns nearby are ready for any attack. Below, hoisting 16-inch high-explosive ammunition for one of the giant railway guns





# "Guadalcanal in Mississippi" Toughens Yanks

Learning tricks of combat zone maintenance, aircraft mechanics (right) repair plane concealed by camouflage in woods. Below, simulating battle conditions, tree trunks form tripod at an "advanced base"



Command's Gulfport (Miss.) Field spends his last five days of training in a mile-long area nicknamed "Guadalcanal" by the first students to struggle with its obstacles. Training here teaches the air mechanics what to expect at advanced air bases in combat, for the men live the rugged life of a wilderness battle front, and still must function as top notch repair and maintenance men. Planes, carefully dispersed and camouflaged, are worked on without benefit of heavy machinery, complete tool kits, and modern facilities of base shops. Along with the training, the field mechanics live in pup tents, eat from field kitchens, and are subject to frequent gas attacks, during which they don masks and continue with their duties.

Isolated in the pine woods of Mississippi, where a tree limb is an engine hoist and a hip pocket a tool kit, aircraft mechanics students are learning the hard, tough facts of combat maintenance and repair. Every graduate of the Army Air Forces Training

complete tool kits, and modern facilities of base shops. Along with the training, the field mechanics live in pup tents, eat from field kitchens, and are subject to frequent gas attacks, during which they don masks and continue with their duties.

## Super-Sized Aerial Freighter Resembles P-38 Fighter

With its twin tail booms and twin engines, the new aerial truckhorse built by Fairchild Airplane Corporation bears striking resemblance to the famed P-38, or Lightning, fighter plane. The new freighter, an all-metal craft, is being built to meet present war needs for carrying guns, tanks, ammunition, supplies and men to distant combat points. It is said to have a range of more than 3,500 miles, and after the war will be readily adaptable to peacetime air service.



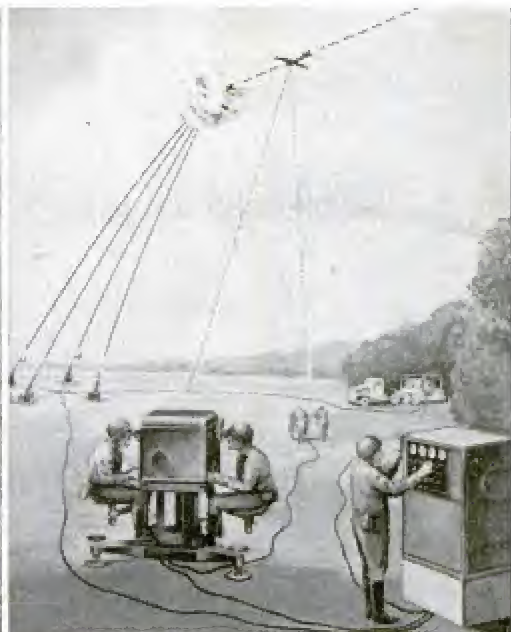
All-metal cargo plane used by Army has range of more than 3,500 miles



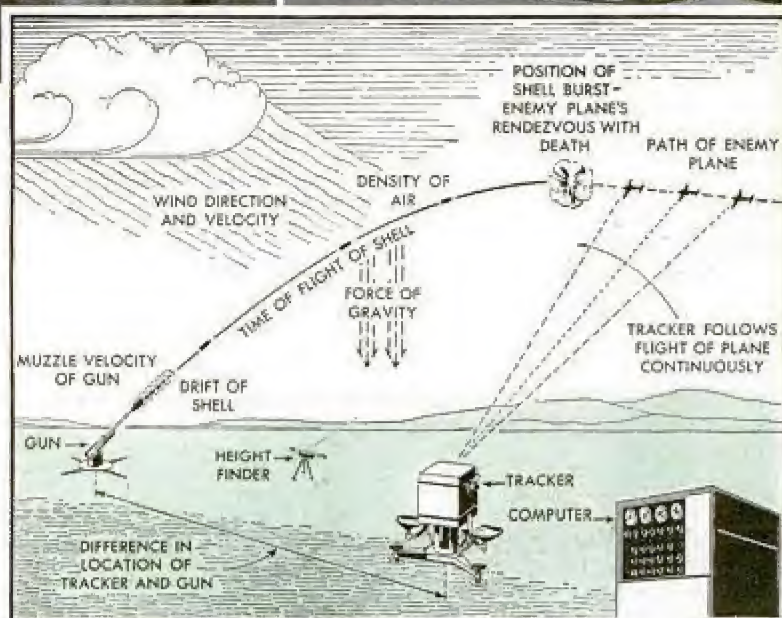
# Electric Brain Directs the Fire of "AA" Guns



Crowds gather to watch new M9 gun pointer during demonstration. Computer is in foreground, tracker in rear



Antiaircraft guns are controlled with an electrical director that fixes the direction and angle of fire and sets a shell fuse so that it will explode in the path of an enemy plane. The complicated fire problem, which the director solves by the use of electrical circuits, takes into consideration the height of the plane, speed of target, muzzle velocity of the gun, wind drift, density of the air, and the pull of gravity on the shell. The setup includes a tracker unit, operated by a crew that must keep the telescope crosshairs on the target, a height finder, the computer and director. The computer makes its calculations continuously during the entire period the target is being tracked. The muzzle of the gun swings automatically to the correct position. The electrical director compensates for human errors, for there is a natural tendency for observers to permit the target to stray from the cross-hairs. The attempt at a quick recovery might be interpreted as a change in the speed of the target. The director ignores momentary



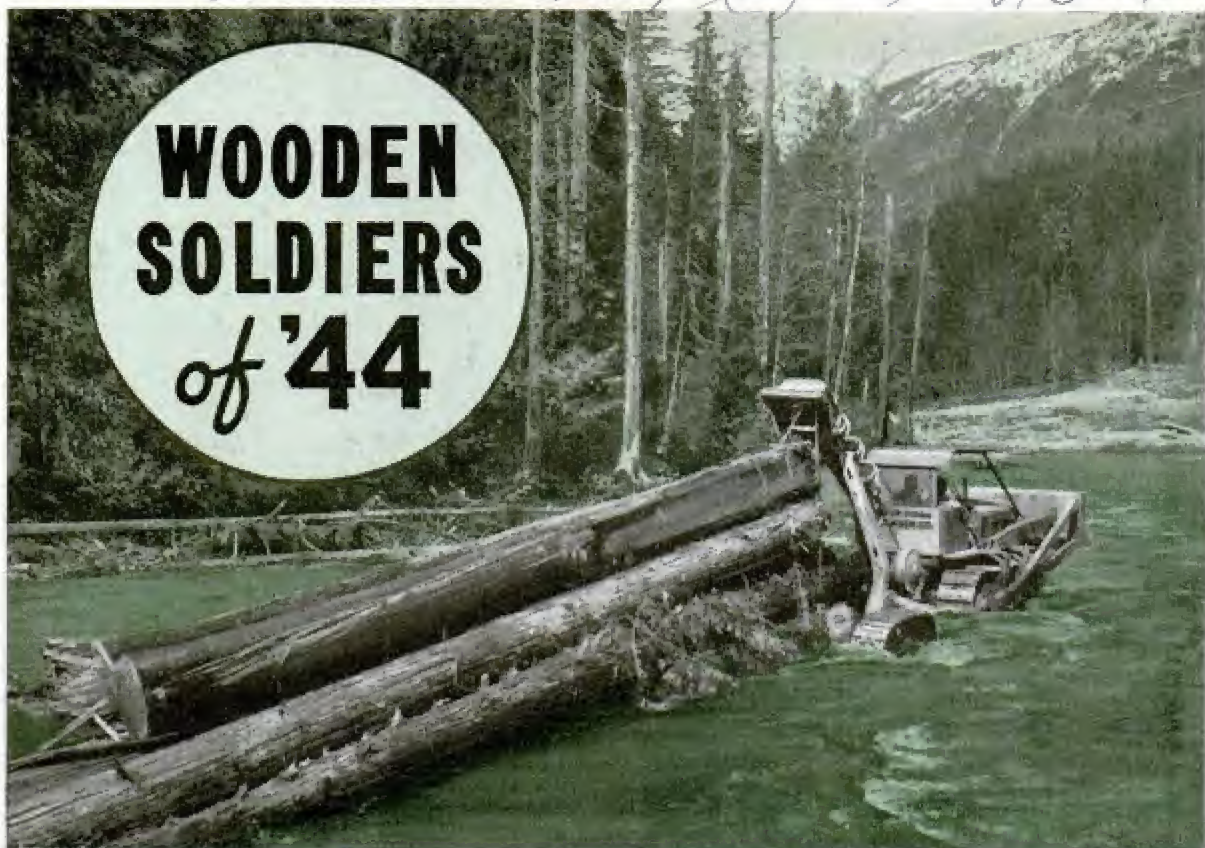
fluctuations and considers only the smooth rate reported over a period of several seconds. Developed in the laboratories of the Bell Telephone Company, the director had its inception in the dream of a laboratory technician, Dr. David B. Parkinson. He dreamed he was operating a deadly anti-aircraft gun equipped with an electrical device similar to one on which he had been working. But before the dream became reality, some 5,000 detailed drawings and 1,100 specifications were prepared for the instrument's 3,300 parts. Although only recently made public, the first test model was delivered to the Army one week before Pearl Harbor.

*Murray Hill*  
*N. J.*



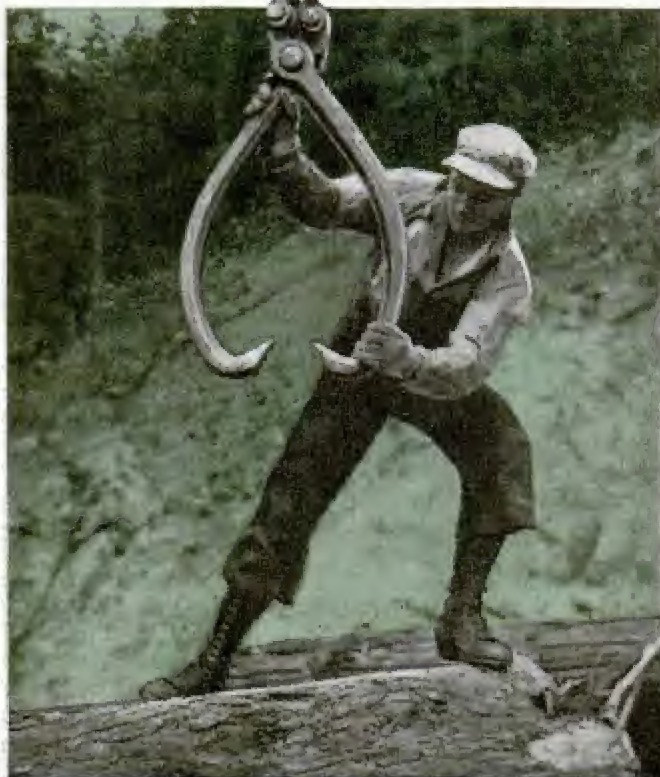
*Sigmund Semeth  
Grandval Farm, Rutland, Pa. 71 544*

# WOODEN SOLDIERS *of '44*



It takes more than a river to stop timber "cat" (above) moving load of Douglas fir

Below, loader swings down heavy tongs to pick up a giant log for loading flat car



**E**VER since 1775 when cannon hauled overland on wooden sleds helped defend Massachusetts Bay, the axes of lumbermen have swung behind every American battle—land or sea. Today, for every man in the armed forces, five trees have gone to war. To meet these increased timber demands, a blitzkrieg has been loosed in the woods.

Mechanized logging, this outgrowth of World War II, has brought the curtain down on the old-style logger. Instead, bright-eyed youngsters with a mechanical flair are the ones who now are feeding the screeching gang-saws. These lads may not know the fine points of handling an ox-team but they know the controls of a Diesel-powered tractor and they know how to use motor-powered saws which keep ribbons of fresh shavings spouting from the slot at the base of a tree. They're our own woods Panzers, 1944 style.

Back in the old days felling a giant Douglas Fir was a major campaign. The job took a two- or four-man crew anywhere from 12 to 20 hours. Tree felling 1944-



style is easier. Bzzzzzt! In less than an hour, once the outfit has been set up, this two-day job is completed. What's more, it saws the stump from two to three feet closer to the ground where it is the thickest and counts the most.

To haul out timber in long lengths, tractors now slip into gear where ox-teams puffed short years ago. Equipped with crawler trailers and a massive steel arch, these hauling outfits lift the forward end of the log and skid it up to the storage or loading area. Water doesn't stop them. Neither does mud. In fact these two obstacles make hauling easier. If small trees up to six inches in diameter stand in the way, these smoke-spouting behemoths just plow on through them. They don't need roads. They make them as they go.

Cutting timber at an unprecedented rate, the lumbermen are interested in planting timber



Lofty perch of "high-topper" vibrates 20 feet each way as top of tree plummets earthward. Below, heavy bulldozer hauling out a large sawlog







Spar tree anchors cable for moving logs; below, bulldozer clearing road



as well. The high-handed woods baron whose motto was "cut out and get out" is now a thing of the past. Instead, progressive far-thinking timber corporations protect their woodland investment by a selective-logging program which yields continuous profits and permits trees to be harvested just like any other crop.

On lands which are burned over or timbered off, the damage is already done. In such areas, where the seed-trees to start natural regeneration of the forest are gone, whole forests are planted. Right now some trained forester may be bedding in earth a tender seedling which may build a home for your grandchildren in 1999.

In a clearing overlooking the Nisqually River in Washington is a typical "tree factory" where the Forest Industry Nursery owned and operated by loggers and lumbermen of the Douglas Fir region turns out seedlings for planting on tens of thou-





Double-barreled "gasser" shoots tear gas into soil to kill weeds before planting seedlings. Right, skidding logs help make a smooth road



Equipped with chemical back-pack tanks, two young foresters "hit the trail" to investigate trace of smoke. They stop spread of fire

sands of fire-devastated acres. Ingenious mechanical methods are used to propagate the trees, to regulate their growth, and to lift them from the beds for packaging so that they may be re-planted on the site of some future forest.

The nursery site was selected after some 400 soil tests had been made. Then the ground was plowed and harrowed and two miles of tiles were laid in the subsoil for drainage. An artesian well was bored and three miles of overhead pipe lines were hooked up for sprinkling. But the beds still weren't ready for planting.

First of all, Superintendent Charlie Rey-







Paper treated to retain fumigating agent aids in sterilizing nursery soil

nolds' "mystery weapon" went into action. This was the gasser, looking like a fantastic item of inter-planetary field artillery. It is pulled by a tractor and operated by men wearing gas masks. No wonder—for this machine pumps chloropicrin (tear gas) into the soil six inches beneath the surface. The ground is then thoroughly wetted, sealing in this non-water-soluble gas. As a result every weed and weed seed perishes.

Next comes planting time after the soil has had an opportunity to air out a bit. Again, labor saving machines give the im-

ing motorized equipment or pack-tanks are ready at a moment's notice to respond to the fire call. Sometimes they're even dropped as "paratroops" to fight fire with its own weapon by "backfiring" a critical area. Commercial timber areas, however, are fairly well criss-crossed with a grid of "fire lines" kept clear twelve months of the year. These check the uncontrolled spread of fires caused by lightning and other natural causes.

Man-made fires in the tall timber are reduced in number nowadays. Lumbermen

are too well aware of what a single incompletely extinguished match can do in the way of damage. In many forest areas cigarettes may only be smoked inside a closed automobile. In certain seasons with the woods tinder-dry, a steel cable chafing where it draws tightly against a stump is all that is necessary to touch off a conflagration.

This respect for fire has led to one of the strangest innovations in wartime logging—the Hoot Owl Shift which goes to work when most workers are quitting their jobs, as evening falls. By working through the night when moisture is condensing from the air the

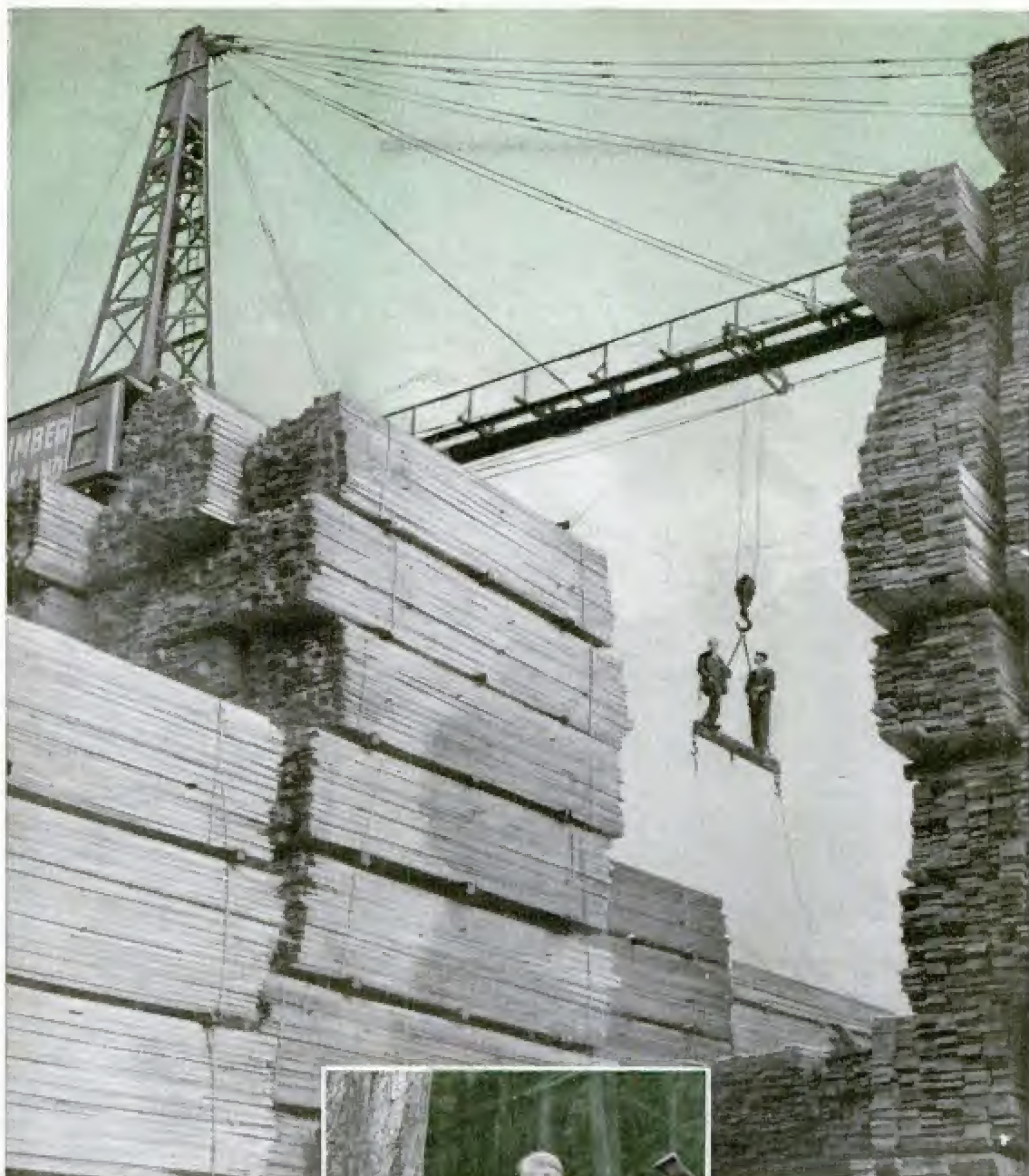
Biting deep into the tree, this saw makes short work of once tedious job



Henry J. Swainson Saw,  
42 32 N. 1st St.  
Philadelphia, Pa.

Mill & Merit Supply Co.  
700 - 4th Avenue  
Seattle, Washington





Mountain of lumber ready for shipment to vital war plants

fire danger during the critical summer season is minimized. In past years logging operations were forbidden entirely during the height of summer heat. By working on the Hoot Owl shift, production goals are maintained without undue risk.

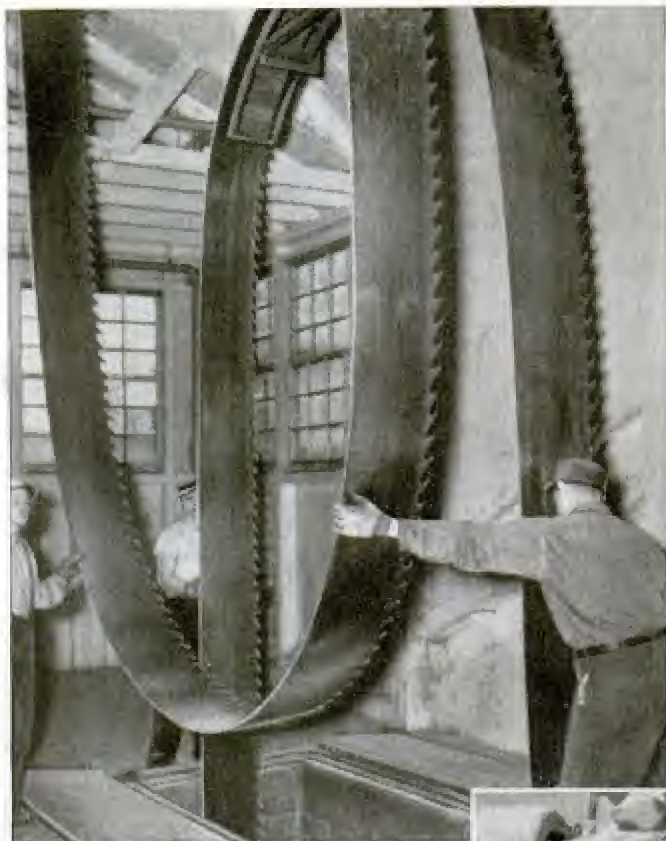
Floating logs down-river has always been a favorite method of getting them to the mill for



The old way of felling tree used to take a man twenty hours

they end up in the mill pond where the water prevents deterioration of the wood. In past years log jams were a menace demanding risk of life and limb in freeing the key log which held up the groaning mass. If efforts to free the key log failed, dynamite was called into play to blow up the log jam. Needless to say, this wasted wood. Last year 50 million board feet of





Sharp teeth of this giant saw will cut the big logs quickly into proper slabs

Seedling cultivator scratches the soil and then tamps it firmly back in place

"Caterpillar" tractor—"Panzer trooper" of woods—replaces old-time methods



lumber swept down Idaho's Clearwater River without a single pile-up.

The secret—dynamite is used before the jam occurs. Rocks and other obstructions on which logs might "hang up" are cleared out of river beds. Hundreds of thousands of board feet of lumber have been saved for military and civilian purposes by this one simple war-inspired change of technique alone.

Other economies in the woods may be seen on every hand. Take the problem of short-length timber for example. Formerly it was wasted entirely or used to fire lumber sawmill boilers. Today it is made into laths or box shooks or barrel staves for lend-lease shipments. Sawdust, used in special burners, or "hogged wood" put through coarse grinders is used as fuel instead.

The real expert at scrap salvage in the woods is Bror Grondahl,





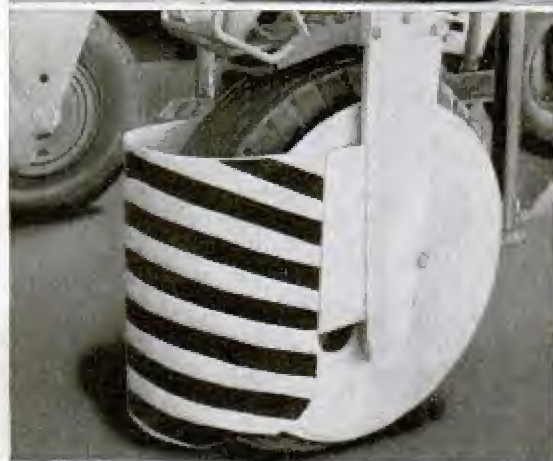
professor of forestry at the University of Washington. He has made a science out of the utilization of miscellaneous waste forest trash such as hollow logs, butts, snags, crooked limbs, branches, and other "slash." Using a portable pulp-mill wood room of his own invention he found that he could cut these leftovers into 2-foot lengths, slab them into 8-inch widths, and chute them into waiting cars ready for processing. His "rig" is mounted on a sled and is tractor drawn. Even if his operation didn't pay cash profits—which incidentally it does—it would reduce the fire hazard and make re-seeding possible in logged off areas. Hundreds of forest salvage units similar to his original model are being completed. The loggers have gone to war. Every thousand board feet of lumber which they produce saves the United Nations 700 pounds of metal!

Loggers with catlike agility making up a log raft in mill pond on west coast. Below, as logs are conveyed up the mill pond chute, streams of water wash off most of the mud and sediment that might dull the saws

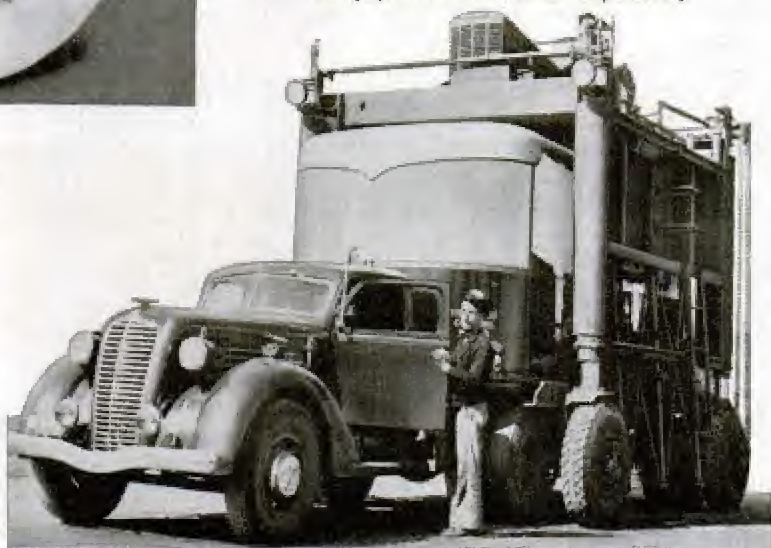




27791



Huge load-straddling trucks built by the Ross Carrier Co. are doing a variety of work in war industries, picking up loads of 10 to 30 tons. The carrier at right straddles a giant highway trailer and lifts it, fully loaded, from its truck bed. Some of the largest carriers are in use in Hawaii loading and unloading 20,000-pound cargoes of pineapples. The crossed members seen between wheels of carrier at right control in-and-out swing of lift hooks which grip the object to be raised. The carriers are commonly used in lumber yards





## Stereoscope X-Ray Gives Depth to Pictures

X-ray pictures in three dimensions are produced with a new stereoscopic fluoroscope, which promises to aid in locating bomb and shell fragments in the wounded man's body. Three-dimensional examination of broken bones is also expected to enable the surgeon to set them with greater accuracy. Conventional fluoroscopes give shadow-images of parts of the body, and if the doctor wished a stereoscopic view, it was necessary to take a pair of X-ray pictures from slightly different angles, then place the films in a stereoscopic viewer. If a physician could view the body "in depth," with the position of the organs in proper relationship, without the need of developing the pictures separately, his work would be eased. The invention of LeRoy J. Leishman of Los Angeles utilizes a pair of X-ray tubes that operate alternately, 60 times a second. The mechanism makes it possible for one eye to see the

*Calif.*



The stereo-fluoroscope offers three-dimensional view of forearm to aid in setting broken bone



Conventional X-ray photograph above shows safety pin in child's stomach, fails to show depth as does stereo-fluoroscope

Sterile needle inserted (right) by means of three-dimensional view guides surgical knife directly to site of the foreign body





77699

# "MAIL ORDER" SERVICE for WARSHIPS

Lieut. Andrew Hamilton  
4205 Hamilton St.  
San Diego, Calif.



the message had been sent, the technicians were installing the crankshaft.

The speed and efficiency with which this job was accomplished is typical of the Navy's world-wide maintenance service. Battle damage may bring an urgent need for parts unavailable in the area of action. Ships under repair at Navy yards and bases often must be provided quickly with the latest equipment.

Within a few hours—days at the most—after the Navy Department in Washington gets a call, the needed parts are on their way to South America, Europe, Iceland, the South Pacific, Australia, Alaska, or wherever the Navy might be.

Sears Roebuck or Montgomery Ward never gave better or faster service

Navy fighting planes need replacement parts (left) to keep at maximum efficiency. Below, a bluejacket in bosun's chair prepares to repair a carrier's deck

**T**HE Teletype in the Navy Department's Bureau of Ships clicked out a message. A yeoman ripped it out of the ticker and handed it to an officer.

The officer scanned it and reached for his telephone. A few minutes later he was talking to Beloit, Wis.

"One of our ships in a South American port has a busted crankshaft," he said. "We need a new one right away."

"Can do," came the answer. "We'll have it on the truck in half an hour."

And it was. The huge hunk of metal—15 feet long and weighing 2,000 pounds—was rolling down the highway in 28 minutes. At another plant, 200 miles away, the crankshaft was given a radiographic inspection, loaded aboard a plane and flown to Miami, Fla. There it was transferred to another Naval Air Transport plane; and a crew of technicians got aboard. Exactly 72 hours after





than the Navy's own "mail-order" maintenance service which keeps hundreds of ships and thousands of planes in tip-top shape to battle the enemy. The Navy is organized on a 24-hour basis for quick action day or night. Calls for assistance are made upon manufacturers, naval bases, supply centers, naval communications, commercial transport of all kinds, Army and Navy air services and our Allies.

Parts for damaged ships and planes have a very high priority in air transportation. Sometimes, when rush orders come through, high-ranking Army and Navy officers, and even courier mail, are put off planes.

For example, a cargo vessel sustained battle damage in European waters. When temporary repairs were made for her return to the United States

Right, a new engine, wrapped in Pliofilm, starts by Navy transport plane for front. Below, Catalina brings cargo to Aleutians







Comforts of home on a four-motored Coronado—a flyer pillages the icebox

for rebuilding, the Diesel generator engines which had been submerged could not be made operative.

"Without electric power, the only way we can get this baby across the Atlantic is to tow her," said the engineer.

"How about replacement parts?" asked the captain.

"Nothing on this side of the Atlantic."

Grumman "Wildcat" fighters to a South Pacific destination.

An officer took the dispatch to the Maintenance Section where another officer telephoned the Columbian Rope Company, whose design for a detachable fuel tank, of plastics, had just been approved.

"It's not yet in production," said the manufacturer.

"Workhorse" of Navy aviation is the Catalina, which will go anywhere, at any time, for any sort of a job





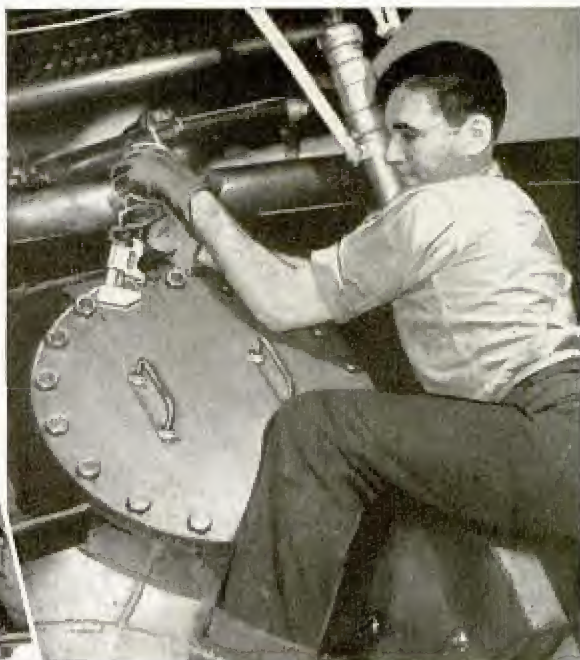
"Got anything on hand?" persisted the Navy officer.

"Well, there are 16 models available."

"O.K.," cut in the officer, "We'll take them. And get the 32 others out as soon as possible."

The company quickly assembled a group of workmen and by the following Tuesday morning—the deadline set by the Navy, the other 32 tanks were ready.

This was only half the order. Another call had been made to the Grumman Aircraft and Engineering Corporation at Bethpage, Long Island, for 192 sway braces to attach the tanks to the wings.



Above, tightening bolts of a condenser plate on ship disabled by enemy action. Left, tying down barrels in a Navy transport plane



Working day and night over the week-end, Grumman employees completed the order.

The tanks and sway braces were flown across the United States to San Francisco by the Naval Air Transport Service. There they were picked up by Pan-American clipper and carried to Honolulu, where the Navy took over again and transported them to a South Pacific Air Base to be fitted to the wings of the Grummans. The Navy fighter planes arrived over Guadalcanal just in time to win an important air battle.

Freighting vitally needed parts half way around the world is routine. A fire aboard a submarine required extensive replacement of the main drive controls and power cables. Just 36 hours after receipt of the first information, the material was on its way by air. It arrived

(Continued to page 162)

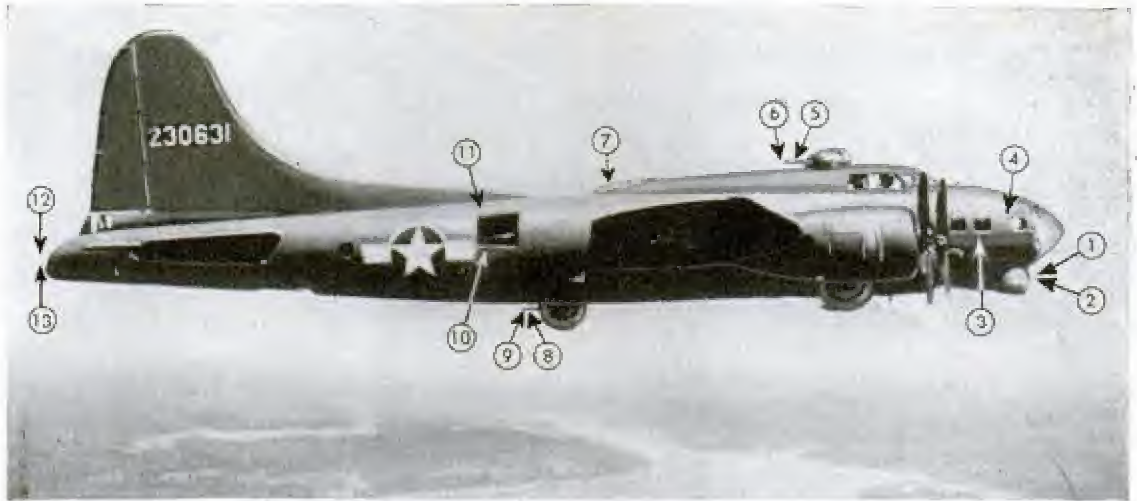


A Wave at Anacostia, D.C., field checks weather map before advising air crews



71871

# Enemy Pilots Face 13 Muzzles of B-17's Guns



America's Flying Fortress lives up to its name with 13 .50-caliber machine guns strategically placed to protect the mighty bomber from every direction. Numbers on the accompanying photograph show the gun positions. Reading from nose to tail, guns 1 and 2 are in the new "chin" turret; 3 and 4 are used by the navigator and bombardier during frontal attacks; 5 and 6 are handled by the first engineer in the top

turret, and can be pointed to the front, side or rear; 7 is manned by the first radio operator in case of attack from above; 8 and 9 are fired by the second radio operator from the ball turret at fighters approaching from below; 10 and 11 in the waist position are operated by the second engineer and first radio operator; 12 and 13 are used by the tail gunner and photographer to protect the rear.

71723

# Stratosphere Brought to Earth Tests Aerial Ammunition



What effect does a temperature of 70 degrees below zero in the stratosphere have upon a gyro instrument that requires air flow? How does the thin air act upon a bullet moving 1,800 miles an hour? Answers to these questions and scores of others pertaining to high altitude flying are being answered in laboratories that are virtually bits of the stratosphere brought to earth. A household refrigerator in the United Air Lines' instrument

shop at Cheyenne, Wyo., has been converted to test instruments under sub-zero conditions. A shelf of Dry Ice plunges temperatures to 35 or 90 degrees below zero Fahrenheit. A vacuum pump and extra electric motor provide the thin air of the substratosphere. At the Remington Arms Research Laboratory, Bridgeport, Conn., ammunition is frozen for firing tests. Studies are made on how stratospheric conditions affect velocity, striking power, trajectory, and the ignition of powder.



## 'Chin' Turret for B-17 Protects Bombardier

Two .50-caliber machine guns are installed in a "chin" turret to protect the bombardier in the latest model Flying Fortress, the B-17G. The new turret is below the bomber's transparent plastic nose. It is power-operated and remotely controlled. With its thirteen .50-caliber machine guns, the B-17F, predecessor to the latest model, was regarded as the world's deadliest bomber. The additional armament, protecting the bombardier's vulnerable position, will add to its invincibility.

*Lockheed - Vega*

Power-operated "chin" turret just below bomber's "greenhouse" on new model of Flying Fortress houses two machine guns to repel head-on attack

*Givens Corp.  
Burbank, Calif.*



## "Landing Mats" Foil Burglar When Placed Over Window

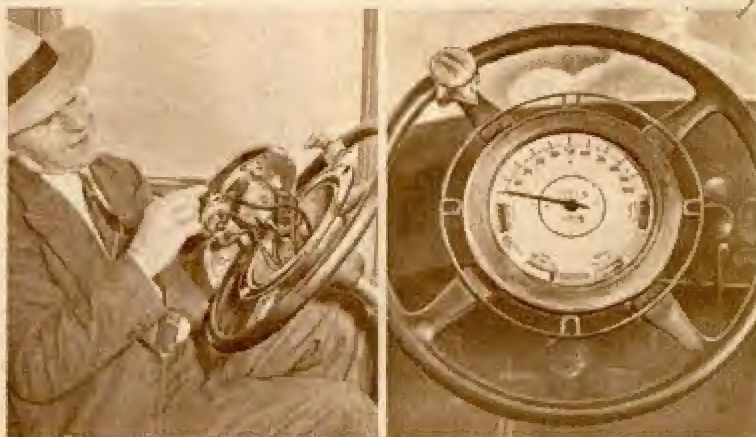


One of the postwar products derived from wartime innovations will be a steel mesh anti-burglar window guard. It is of the same mesh design now used for portable landing mats at airfields in advanced war zones. The window guards, like the mats, are diamond patterned with horizontal bars running through the design which is about one inch in depth. A burglar would have to cut bar after bar in minute sections to break through. Aside from its utility, the mesh gives a pleasing appearance in comparison with the prison type of window bar.

Steel mesh window guard, similar in design to portable landing mat, has criss-cross of bars not easily cut

## Auto Gages in Center of Steering Wheel Can Be Read at a Glance

Automobile instruments are mounted in a compact group on the steering wheel, in a design proposed by a California motorist. A circular instrument panel fits inside the usual horn ring without interfering with steering movements. The panel contains the speedometer, fuel gage, oil gage, engine thermometer, and ammeter.



MARCH, 1944

*C. A. McComb  
4425 Shaw St.  
Long Beach, Calif.*

*Arthur L. Brown  
Young's Printing Co.  
132 W. 42nd St.  
N.Y.C.*

*77914*



*Donald C. Hanson Jr.  
 3872 Franklin Ave.  
 Los Angeles 27 Calif*



The Douglas Havoc fighter-bomber's nose is studded with cannon that can sink a destroyer

## The FLYING CANNONEERS



a Mitchell bomber flying at 250 miles an hour put 22 out of 25 shells through a six-foot target more than a mile away. The big problem was recoil, but it was solved and the Mitchell's new gun is said to fling a 20-pound shell with precision over an effective range of several hundred yards.

The flying cannoneers ride the Mustang, too, and the Douglas Havoc, and

Left, installing 20-mm. cannon in Mustang's wing. Below, crescent of oil slick trails a Jap destroyer hit by Mitchell's bomb  
U. S. Army Air Forces photo

THERE was a gleam in the gunner's eye as the Mitchell bomber leveled off and five parcels of TNT were dispatched, air mail special delivery, straight into the vitals of the Jap destroyer.

The crew of Nipponese never knew what hit them. Tokyo's Navy Intelligence office can read all about it now . . . the surprise package from Uncle Sam was a 75-millimeter gun on wings, the biggest member of our growing family of flying cannoneers.

In World War I the "75" was the famous field gun of the French. Today a light weight version has been adapted for war in the sky, and already it has become legendary. The story is around that in target practice before it went to war,







Above, girl armorers test .50-caliber gun on firing range. Right, one B-25 photographs another swooping on Jap destroyer U. S. Army Air Forces photo

the Airacobra, with the 37-millimeter wallop in its nose.

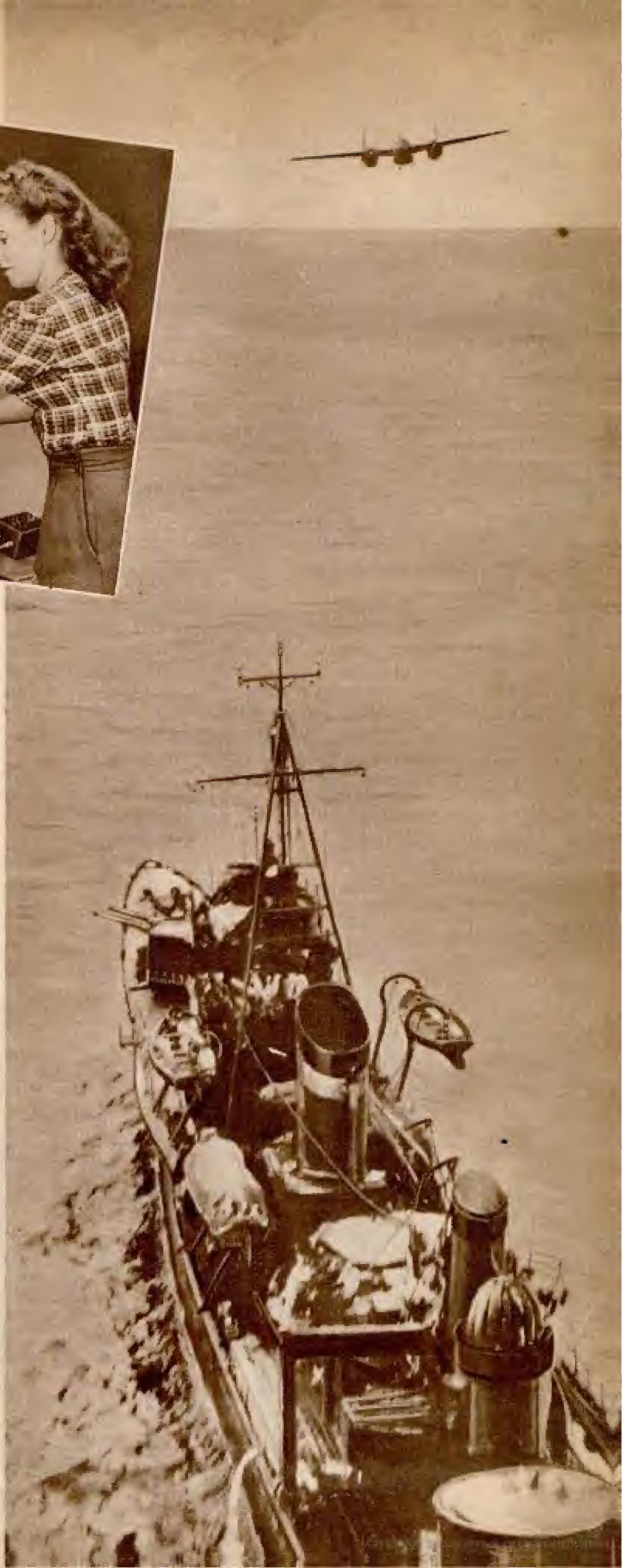
Down in the South Pacific a big Douglas A-20 slanted its nose down at the Jap destroyer that was churning a wake like the tail of a drunken comet behind it.

The A-20 had a belly load of bombs, but right now the pilot's thumb was reaching for the button on his control wheel marked "Guns." He pressed it and the rumble of cannon fire crowded out the roar of the engines. A sheet of red flame washed up momentarily in front of the cockpit windows. The pilot leveled off, then nosed down sharply for another burst.

He didn't need to make a third attack. The destroyer's deck was smoking when the first rounds struck home and now you could hear the rear machine gunner calling excitedly on the intercom: "You got 'im! He's blowing up right now!"

The A-20 Havoc has been put to 27 different uses in this war, including medium-level bombing, dive bombing, ground strafing, and reconnaissance. One of the latest versions of the A-20 is the P-70, painted jet black and used as a high speed night fighter. Another version has four 20-millimeter cannon projecting from its nose, armament that makes it more than a match for a destroyer.

MARCH, 1944







B-25 Mitchell medium bombers cross the Mediterranean in formation for attack at low altitude

Aerial bombs are a deadly weapon but you can't beat an aimed gun when it comes to pinpoint destruction. A small cannon shell can penetrate medium armor, rip a tank apart or set it on fire. Attack planes were an Army favorite a few years ago, then the first stages of the war laid stress on bombers and fighters. Now the attack plane is coming back. The Douglas Havoc, able to outrun most pursuits at low altitudes, is one such attack plane. Many fighters are frequently used in attack tactics. Even medium bombers such as the B-25 are coming down to the ground to drop their bombs on moving targets or skip

a bomb into the wall of a munitions factory.

You might regard a Lockheed P-38 as ideal for aerial combat, yet it is operated as an attack plane more often than you might suppose. Its big .50-caliber guns and its 20 mm. cannon have stopped tanks in their tracks, have sunk a destroyer or two by blowing up their ammunition chambers, and a P-38 has even sunk a submarine by gunfire. One ingenious P-38 pilot got a Jap freighter by starting a fire on its deck. First he raked the ship with incendiary bullets, then made a dive-bombing run and released his external drop tanks. When the fuel tanks hit the deck they split open, releasing gasoline that exploded over the ship.

North American Aviation's P-51 Mustang fighter is one of the flashiest attack planes of all when put to that use. Its pilot operates a battery of four 20 millimeter guns studding its wings.

The special job of the Mustang is that of train-buster. It tears across country like a ricocheting shell, hugging the ground. The pilots like to go out on lone wolf raids, or in strings of three or four, single file. Their targets have been the locomotives that haul war goods



Six .50-caliber machine guns are used instead of four cannon in one version of the A-20 Havoc



and troops through Hitler Europe. You hear the roar of the oncoming plane only a split second before its cannon open up on you. Then the plane is gone before a ground gunner has half a chance at it.

Things happen fast to the pilot hedgehopping at better than 350 miles per hour. A good Mustang pilot has the knack of close and accurate observation at high speed. He must be able to point his plane at the target the instant he sights it and automatically give it a "squirt" with his guns. Sometimes a locomotive hit by the 20 millimeter shells blows up, other times it simply spurts steam in all directions from punctured tubes. Then the pilot rakes the cars.

Operating from Great Britain, a Mustang pilot often crosses the channel, uses up his ammunition in a sweep across part of western Europe, and returns to base in less time than it takes his ground crew to have lunch. One pilot may report that he put a few holes through a water tank, knocked out three locomotives, shelled a war factory, and destroyed some barges in a harbor. Another's report will include knocking out half a dozen parked aircraft, blowing up a pair of locomotives and smashing a number of railway signal boxes. Within a few days two squadrons of Mustangs wrecked 20 locomotives, seven tugs, seven armed trawlers, and many facto-

(Continued to page 150)



The U. S. Army Air Forces took the lead in standardizing the .50-caliber machine gun as an aerial weapon, potent both for defense and attack. Here are guns for installation on A-20's

Originally a fighter, the Mustang became an "intruder" and acquired the row of four 20-millimeter cannon seen protruding from its wings, which were reinforced to take the heavy guns





*Gandolph Roberts*  
*341 N. Canada St., Arlington Forest, Arlington, Va.* N 916

## Soldiers Build 185-Foot Bridge as Final Exam



At a railway bridge-building school in England, U. S. soldiers of the Corps of Engineers must build a 185-foot bridge to pass their "final examinations." The men learn to work with British tools and equipment which will be used in Europe. They are taught to build their own derricks and operate them by hand, to bolt I-beams, girders, joints and pieces of steel tubing. After preliminary techniques are mastered, small bridges are constructed. Finally, the big 185-foot span is built on four-wheeled dollies, and the bridge rides on railroad tracks from the edge of the river to extend out over the water. A derrick on the opposite bank launches the bridge and the trestle piers are moved into place. The bridge will support a freight train loaded 20 tons to the axle.

First section of bridge being launched from shore to pier, lower left, in England

N 932

## Electric "Tractor" Led by Hand Hauls a Two-Ton Load

Electric pushbuttons mounted on the steering handle make it easy for a girl to transport loads up to two tons on a motorized pallet. The midget tractor travels backward and forward, driven by a battery and guided by the operator who can swing the steering handle in its 210-degree arc with a light touch. Hydraulic foot controls lower and raise the pallet.

Wooden pegs perform the work of dynamite in some European quarries where they are driven in holes bored in the rock and then soaked so they swell and split the rock.



Battery-driven tractor does the work, controlled by pushbuttons on handle

*Automatic Transportation Co.*  
*101 W. 87th St.* POPULAR MECHANICS  
*Chicago, Ill.*



*Mr Robert Clark  
540 Pkwy Bldg.  
Pasadena, Calif.*

*77 9 15*

## Gun Trainer Fires a Fluorescent Plastic Pellet

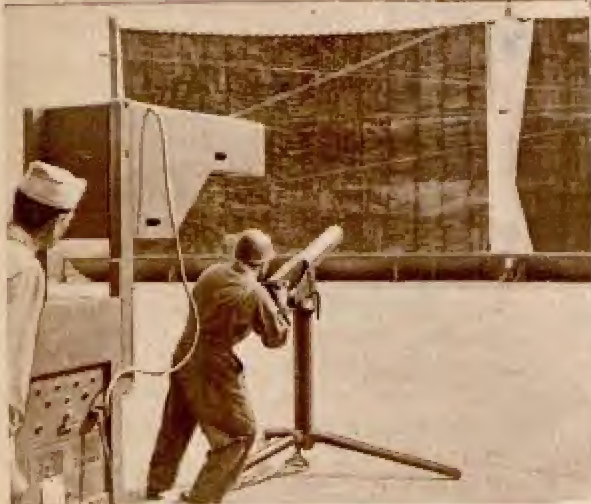
Gunners learn to fire by tracer stream rather than the conventional method of aiming at a target with a machine gun trainer, the M9, that fires fluorescent pellets at night. A beam of ultra-violet light flashed on the plastic pellets simulates the tracer stream. Fluorescent target planes look like enemy craft caught in the beam of a searchlight. White pellets are used during daytime practice. The gun itself is similar in size to the .50-caliber anti-aircraft machine gun. It is electrically controlled and the plastic pel-



Rays of ultra-violet lamp (left) beneath water jacket of gun are focused in limited area around target. Right, target is operated by soldier turning reel. Practice enables him to simulate speed of plane



Firing the M9 trainer. Structure at rear houses gun when not in use, also an air compressor; the loudspeakers are overhead. Left, target plane looks like real thing



lets are fired by a pneumatic device. The time of flight of the pellets when aimed at a target 50 yards away is the same as a .50-caliber bullet under actual firing conditions at 500 yards. When the gunners fire, sound equipment reproduces the blast of a real machine gun, the roar of diving planes, whine of shells, and firing of heavy guns. The targets, supported on a wire with a tow line attached, are models of Jap and German planes.



# LIQUID *of a* THOUSAND USES



U. S. Navy photo  
Glycerin is a chief ingredient of camouflage paint on patrol ship, and it is vital in manufacture of surgical dressings and antiseptics

eat, the beverages you drink, the cigarettes you smoke and the soap you use. It is a solvent, a preservative, an emollient, a hygroscopic agent (absorbing and retaining moisture), a food—and a strategic material of war.

The name of this product is trihydroxy alcohol, or in common language, glycerin. It has been called the liquid of a thousand uses.

In normal times, people of the United States use some-

**I**T'S VITAL in producing high explosives to destroy the enemy. Yet it's used in antiseptics and surgical dressings and as a base for sulfa ointments that save men's lives.

It's in the tough, quick-drying paints covering tanks and ships and planes. It cleans workers' goggles. It's in the hydraulic mechanisms of big guns. It's a de-icing agent for airplane wings.

In your home, you'll find it in the family medicine chest. Unless its use has been curtailed by the war, it's in the food you

thing like 150,000,000 pounds of glycerin every year, over one pound per person. But wartime uses are so great that drastic steps have been taken to conserve supplies by cutting down or eliminating glycerin in a long list of civilian products, including cosmetics, dentifrices, lotions, beverages, candy and all edible products except margarine, chewing gum, shaving cream, adhesives, tobacco, emulsifiers for shortening, protective coatings, soaps, shampoos and hair tonics.

The average individual considers glyc-





er in an essential war material because he thinks of nitroglycerin and other explosives. In point of fact, only about 23 percent of the 1943 production of absolute glycerin will go for explosives, according to the Glycerin Producers' Association. The biggest share of the estimated 150,000,000 pounds produced will go into alkyd resin paints used as protective coatings by the Army and Navy. Some 42 percent of production will be used for that purpose, glycerin being one of the two principal ingredients of these paints. The other is phthalic anhydride.

The remaining 35 percent is distributed over countless products for war and domestic use. The Department of Commerce lists some fifty major industrial uses, from medicines to shoe blacking, from hats to shoes, from anti-freeze preparations to perfumes.

Apart from its use in munitions, surgical dressings and medicines, war uses of glycerin have been expanded to include camouflage coatings, cellophane, glassine and greaseproof papers, military dyes, hydraulic control mecha-

The "liquid of a thousand uses" is a deicing agent for planes. To meet war needs for glycerin, each housewife should save at least a tablespoonful of waste kitchen fat daily







U. S. Signal Corps photo  
Tons of paint come from glycerin derived from waste fat drives

nisms, leather softeners and shoe manufacturing adhesives.

In drugs and pharmaceuticals, glycerin provides, in certain cases, a soothing property; in others it acts as a preservative. In the preparation of basic pharmaceuticals, glycerin enters into a chemical reaction and loses its identity. This also is true in explosives and synthetic resins. In the majority of other uses, glycerin acts either as a plasticizer to provide softness and pliability or as a humectant causing the retention or attraction of water such as might be desirable in tobacco products.

Since the start of the war, the glycerin

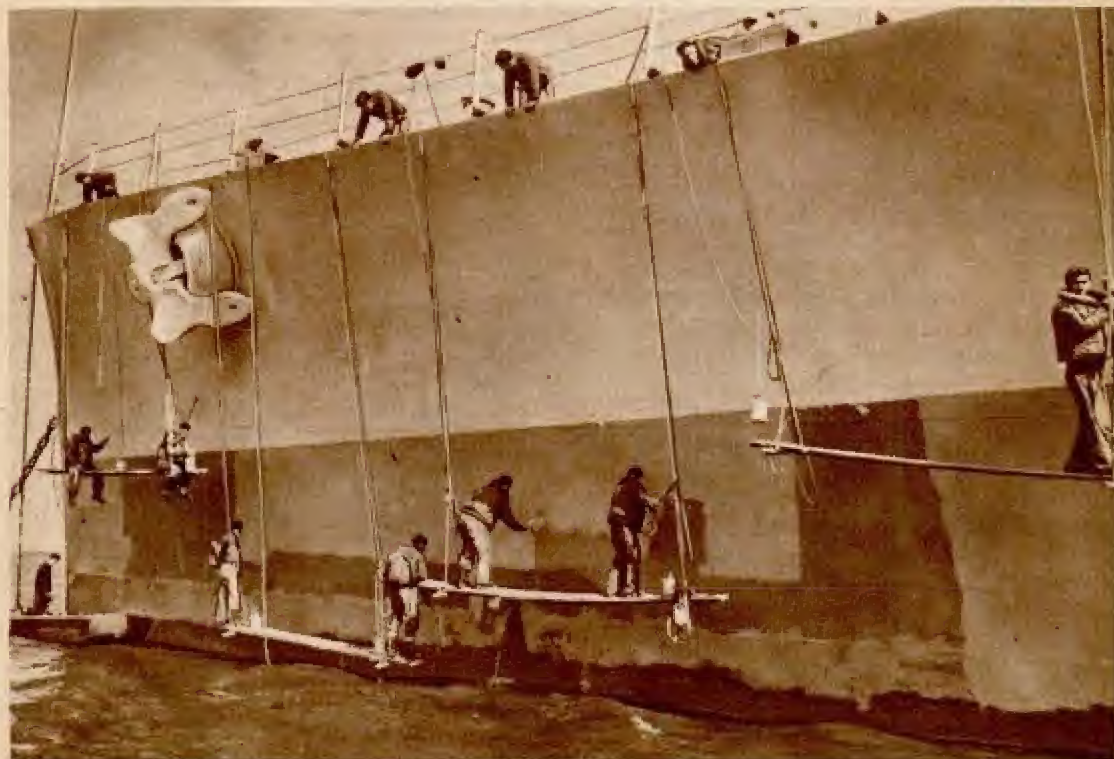
situation has become more and more critical. Shortages were apparent long ago when imports of fats and oils from the Pacific area, formerly amounting to a billion pounds a year, dwindled to almost nothing. Then war production drew more and more glycerin into industrial uses.

Glycerin belongs to the alcohol family. It is obtainable through three processes. One is called "fat-splitting," a complicated process whereby basic fats are divided into their component parts, of which glycerin is one. This method now accounts for some 10 percent of glycerin production. The second process is

through the fermentation of sugar, followed by chemical distillation. This is Germany's largest glycerin source.

The third process, far the most important, is production from byproduct fats and oils during the manufacture of soaps and fatty acids. In saponification, or soap-making, fats and oils are rendered in much the same manner as lard. Soda or potash is mixed with them, and salt is added. The resultant heavy brine, containing glycerin and impurities, sinks to the bottom and the pure soap remains on top. The briny residue contains from 2 to 15 percent glycerin. After treatment to remove impurities, the

Of 150 million pounds of glycerin produced in 1943, 43 percent was used for paints and protective coatings  
U. S. Navy photo







residue is evaporated and most of the salt is crystallized, resulting in crude glycerin of 80 percent concentration.

Distillation of crude glycerin with superheated steam in a high vacuum produces "chemically pure" glycerin—95 percent glycerin and 5 percent water. Further concentration reduces the residue of water to  $1\frac{1}{2}$  percent or less, supplying a glycerin suitable for the manufacture of explosive compounds such as dynamite, double base powder and other "end" products of nitroglycerin.

Because the bulk of the glycerin comes from waste fats and oils, the government is pushing its campaign to obtain waste kitchen fats, but according to last reports the results do not measure up to the quota of 200,000,000 pounds annually. One pound of waste fat will produce enough glycerin to make 1.3 pounds of gunpowder, half a pound of dynamite, or one-fifth pound of nitroglycerin. Fifty pounds of waste fats will produce sufficient glycerin, if used in the manufacture of synthetic resins, to coat one medium tank.

Glycerin became a war material in 1862 when an obscure Swedish scientist combined it with two acids—nitric and sulphuric acid—to produce nitroglycerin. This scientist was Nobel, of peace prize fame, and it was his prediction that his new explosive was so destructive it would make war impossible. Fighting with nitroglycerin, Nobel believed, would be more terrible than the human mind could endure.

(Continued to page 150)



This vital fluid is also the base for explosives used by Army and Navy

Soothing for earaches, glycerin is a remedy in most home medicine kits

Important in the chemical industry, glycerin is used in rayon processing





158 N. Reynolds, Ill.  
Chicago, Ill.

Shond Mfg. Co., Inc.  
**"Fence" Protects Hands  
Of Press Operator**

N 254



Staples of enclosure guard for press are adjustable

Long staples that are adjustable as to length and the angle of their tilt form an enclosure guard protecting the hands of the press operator. The operator views the work through a transparent shield, which can be installed at the front or at the sides of the guard. A universal clamp holds supporting rods with a clamp screw, and allows instant adjustment of the gates, which swivel in or out for convenience of front or side feed. Adjustable staples slide up or down for close adjustment to die, or for straddling any obstruction. A single locking screw holds each complete staple, and staples may be removed or added to accommodate different sized dies.

N 940

**"Half-Tap" Restores Phone Line  
Without Interruption**

Shattered communication lines are made to function normally while permanent repairs are being made with a "half-tapping" set. This device, developed by American Telegraph and Telephone Company engineers, is used with a high frequency identification set to reduce emergency repair time by 50 percent. The identification set identifies pairs of wires, and when attached to them does not interfere with conversation or other service on the temporary line. At a demonstration in Philadelphia, line-

44 Philadelphia, Pa.

men used half-tapping and high frequency identification sets in repairing a broken cable without disturbing music which was being transmitted over one circuit.

N 706

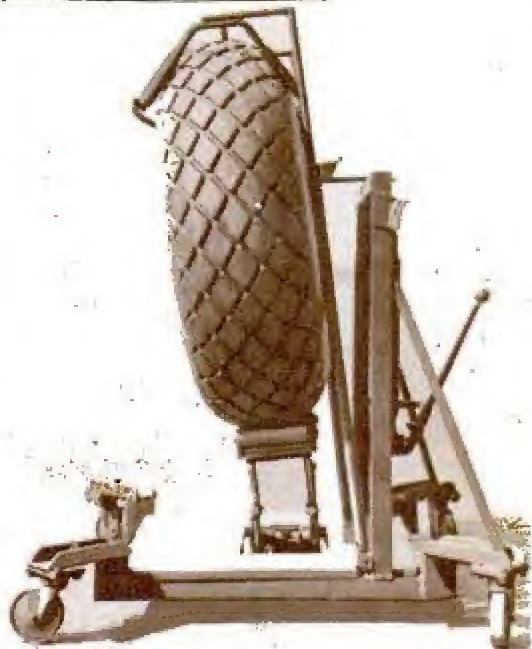
**Inner Tubes of Elasto-Plastic  
Termed Superior to Rubber**

Development of an elasto-plastic material that, its inventors say, may outmode rubber in automobile inner tubes, as well as in other products, has been announced by Glenn L. Martin, the aircraft manufacturer. Not a synthetic rubber, the new substance, called Marvinol, is 100 percent reclaimable. It also retains air to a remarkable degree, since automobiles were driven more than 6,000 miles without the need to add a single pound of air to tires fitted with inner tubes of the new substance.

Baltimore, Md. N 792

**Changer for Big Airplane Tires  
Moves Wheel Any Direction**

Two 580-pound airplane tires can be changed in an hour by two men with a tire changer mounted on a low-slung wheeled platform. This tire-changing job was formerly performed by six men in three eight hour shifts. The operator can lift or lower the wheel gradually or move it in and out with a small crank at the top and a hydraulic pump at the side. Thus the wheel may be easily slipped on the dummy axle where the tire is removed from the rim. The changer was developed by mechanics of American Airlines, Inc.



This changer handles tire in fraction of former time

POPULAR MECHANICS

Luther Mead  
100 E. 42nd St.  
N. Y. 17, N. Y.

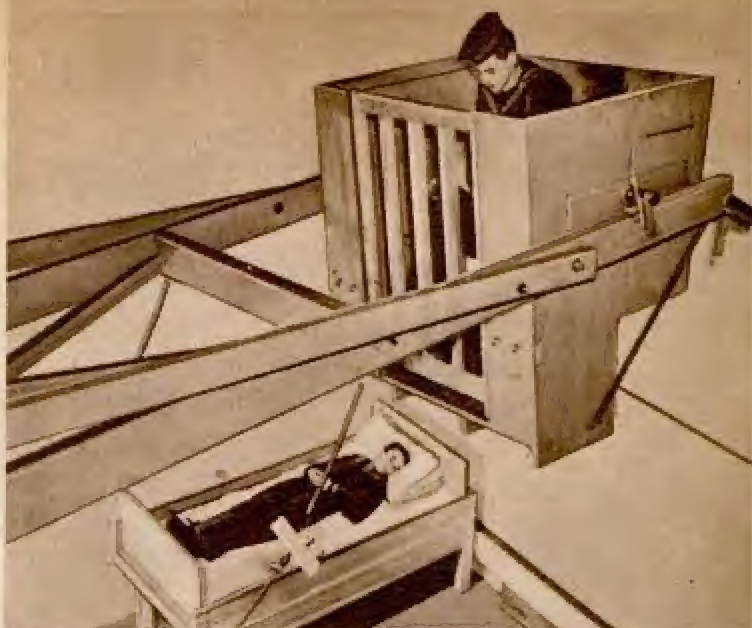


71 887

## 'Seasickness' Machine Tests Capsule Remedy

Seasickness can be prevented or cured in three out of four cases with capsules developed by the Royal Canadian Navy. To test the pills, sailors rode a special "seasickness" machine that pitched and rolled like a small craft in a heavy sea. The formula for the capsule is a military and naval secret, but it will probably be available for civilians after the war. The pills, which are being manufactured in quantity, do not reduce fighting efficiency or have any harmful effects. They are also effective for air sickness.

Sailor in the "bird cage" tosses and rolls on the roller-see-saw machine, while a buddy (below) is recuperating



*Bernard Rock*  
Suction cleaners serve as barber's tool (above) and handy leaf "sucker-upper," below  
*Springfield, Ill.*

## Vacuum Cleaners "Rake" Lawn or Scalp

Suction cleaners have been put to work in novel ways by the Department of Public Works of Columbus, Ga., and a barber in Springfield, Ill. The former designed a "leaf sucker-upper" which sucks up dry leaves along the parkways and crushes them for use as mulch in parks and gardens. Suction is created by a three horsepower gasoline engine. The barber uses a vacuum cleaner hose to remove loose hair from a customer's head, which saves the porter from sweeping it off the floor or the customer from getting it down his neck and on his coat collar. When not in use, the attachment hangs on a wall hook within handy reach of the barber.



*Dept. of Public Works,  
Columbus, Ohio*

## Unsinkable Lifeboat for 25 Uses Motor or Sail

Designed for use aboard maritime ships is an unsinkable lifeboat, which will hold 25 persons. Weighing 5,000 pounds, the craft is decked over to protect occupants from the weather. It is 24 feet in length, and is so designed that it may be powered by motor or sail.

This 5,000-pound unsinkable craft with "all-weather" deck is built to withstand severest storms on ocean. It is carried aboard maritime ships



MARCH, 1944

71 907



# WINGED AVENGERS *of the NIGHT* 71829



*Army Air Forces School of Applied  
Effect of Radio (Radio Officers)  
Orlando, Fla.*



In the "ready" tent at school for night fighters, radio officers plot out mission on maps spread over the floor, while pilots kill a little time waiting their turn to fly. Many of the pilots are wearing special red goggles to accustom their eyes to darkness. Left, pilots studying images in Hunt trainer mirror to judge night distances.

All photos by Army Air Forces

Miniature stage of the Hunt trainer (right) uses combinations of colored lights to simulate lighting at any time of day. Plane silhouettes are suspended from top of stage and moved about realistically. Mirror in adjoining room reflects the image to the eyes of student pilots





**P**HANTOM fighters that strike through the night with deadly accuracy are shooting down unsuspecting German bombers, blasting railway locomotives, and wrecking strategic installations. Night fighters, developed as a defensive weapon in the Battle of Britain, are now using offensive "intruder" tactics. They join formations of enemy bombers and shoot them down when landing lights are turned on. In the South Pacific, a Jap pilot who was a nightly nuisance was downed by a night fighter.

For this job, the Allies have converted A-20 Boston Havoc bombers into night fighter planes. Bomb bays are removed, the transparent nose closed, and fighter guns added. The crew consists of a pilot and a radio officer who navigates the plane and operates its direction finding devices. Painted black, these fighters are able to find enemy bombers in the dark and fire at them with surprising accuracy.

Crews are trained at the Army Air Forces School of Applied Tactics, Orlando, Fla. Here newly commissioned pilots and radio officers live under simulated battle conditions. Every night they take to the air to perform practice missions. It may be a flight out over the gulf or over the swamp lands of central Florida. During the daytime the pilots spend hours in Link trainers, becoming experts at instrument flying. Special devices, such as the Hunt trainer and silhouette gunnery models, train the eyes of the men to pierce darkness and distinguish planes by moonlight. The pilots wear specially built red goggles several hours before taking off each evening to condition their eyes to the strain of darkness. They listen to lectures from experienced night fighters returned from combat.

The full story of Allied night fighters cannot be told until after the war, for their success often depends on what the enemy doesn't know.

MARCH, 1944



Briefed and ready, night fighter pilots leave practice operations tent all set for mission. Before takeoff they'll remove goggles



Down the runway at dusk roars a night fighter with its two-man crew. Below, special projection type gun trainer used to develop ability to fire aerial gun at night. The classroom is blacked out





*Victory Products Corp.  
1230 N. Wacker Dr.  
Chicago, Ill.*

## Blueprint Portable Printer Doubles as Photo Drier



Unit makes several small prints or one 24 by 34-inch

Blueprints can be produced in three minutes from the time tracings leave the drafting boards with a portable unit. This printer also makes black and white prints and serves as a photo print drier. Its lamps give a minimum of 750 hours service.

## Machine Removes Berry Caps By Wringer-Like Action

Capping of strawberries by mechanical means is possible with a machine consist-



Berries fed into top hopper come out hulled below

*Arthur H. Morgan  
Research Dept.  
Univ. of Tennessee, Knoxville*

*The Shawmut Woolen Co.  
Shawmut, Maine*

ing mainly of a vertical cylinder, made up of small motor-driven rollers. It removes the caps from the berries 30 times faster than the most skilled hand-worker. Berries fed into a hopper at the top drop evenly to 10 truncated cones or shelves around the drum. Rolling down the inclined shelves, their hulls are caught between the turning spindles made of rubber and fluted brass, alternately placed. The wringer action draws the leaves and stems into the cylinder, where they are washed away, while the hulled berries land in containers.

## Parachute Rolled in Container Drops 23-Pound Bomb



Cylindrical container and parachute weigh 23 pounds

American fliers, in low-altitude assaults on enemy personnel and equipment, have made outstanding use of parachute bombs. The parachute unit is attached to the bomb, and delays its fall until the plane is safely beyond the range of the ensuing blast.

## Non-Corrosive Rifle Cartridge Saves Cleaning Bore of Gun

Gun barrel cleaning is reduced to a minimum with a non-corrosive cartridge that leaves no damaging deposit in the barrel. A new primer, developed for U. S. troops by the Winchester Repeating Arms Company, coats the bore with a protective deposit. The cartridge is used in the .30 caliber carbine.

*New Haven, Conn.*  
POPULAR MECHANICS



Mr. Powell Clark, Box 5403 Metro Station  
Los Angeles, Calif. 71-662

## Air Transport Crashes on Train—In Miniature



When the script called for an airplane crash with a train, the special-effects men of the Republic Studios got out their tools to rig up the set shown above. Poised on the track is a miniature of a Jap army freight train. Above it is the airplane, which is to plunge down upon the moving freight and blow it to destruction. The plane is suspended on hairlike wires, and will slide down from the 40-foot platform seen in the background. In the foreground is an electric motor and pulley—the motive power to pull the freight cars on their track. The plane will be loaded with small powder bombs and balloons filled with gasoline, so that it will explode and catch fire



Before the cameras roll, the crewman above lines up the plane to make sure it will hit the train at the proper angle. Supports are removed before filming



Above, a fraction of a second before the explosion, "Burning" plane is gliding down to wreck the train. Cameramen work in bombproof hut built to guard camera equipment from flying debris. Scenes like this cost several thousand dollars to stage. Below, debris fills air as plane hits train and both blow up





# GETTING 'EM



Carrying guns and full packs, invasion troops train for most dangerous military operation. Below, marines in Higgins Boat



**T**IN PAN Alley in the last war produced a ditty entitled, "It'll be a Great Day for the Army When the Navy Brings 'Em Home."

All of which is very tuneful, but the Army is satisfied right now to get where it's headed for. Catching a ride home from Berlin and Tokyo will come in due time.

One of the most dangerous military operations is landing troops and supplies on an enemy-held coast. Men are exposed to murderous gunfire, supplies can easily be sunk and heavy losses have been suffered in such operations.

But American forces have swarmed ashore in the Aleutians, in the South Pacific, in North Africa, Sicily, and Italy with great success despite the hazards involved. Even at "bloody Salerno" where the Germans held all the advantages, the U. S. Navy put General Clark's Fifth Army ashore with nothing like the "massacre" the Germans predicted.



# ASHORE



An army tank rolls from huge LST drawn close to shore

And when the real second front in Europe is opened, the Navy will be working alongside the Army again in this new type of warfare called amphibious invasion which the average, hard-bitten Navy coxswain nonchalantly refers to as "getting the guys ashore."

Behind the successes on the beachheads is a story of planning that staggers the imagination. It has two phases—building ships and training men. Never before has such a large fleet of vessels been built in so short a time—some of them fragments of ideas in ship architects' brains 20 months before being put into use.

The Navy's experiments with landing craft go back to the winter of 1935-36. The Bureau



Troops (right) transferring from personnel barge to a raft. Below, bringing planes ashore at island outpost







Loading 14-ton truck which carries troops inland

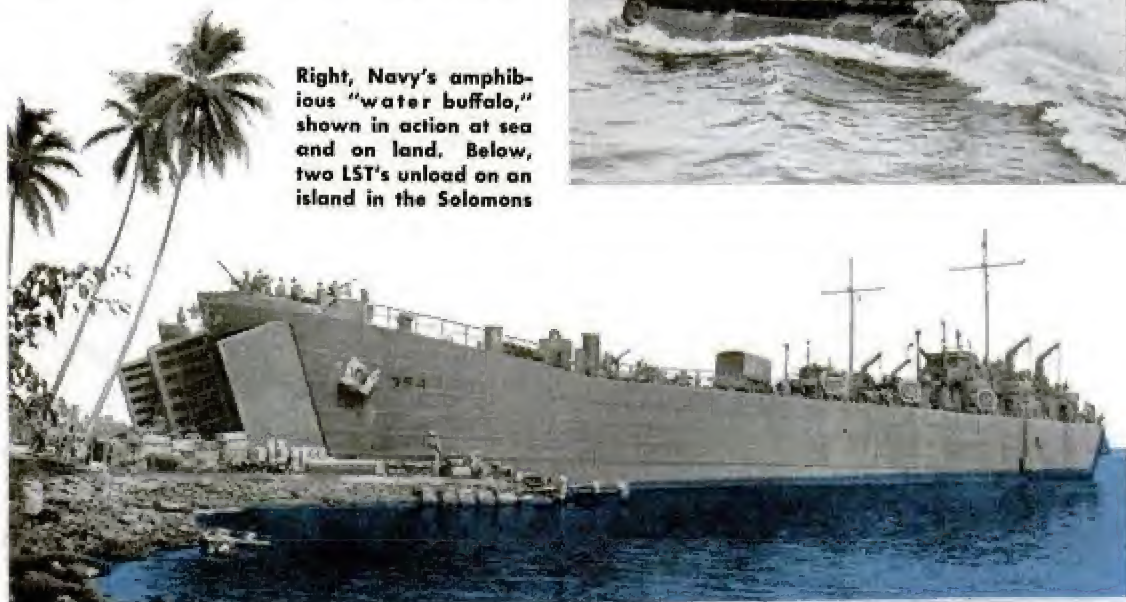
of Construction and Repair (now part of the Bureau of Ships) had ordered various types of landing boats to be carried on the boat davits of transports and auxiliary vessels and to be used where docks were not available. For several years commercially built craft were tested. Finally several major types were developed and adopted by the Navy. These included "LCV's" (landing craft, vehicle), "LCP's"

(landing craft, personnel), "LCR's" (landing craft, rubber), and "LCI's" (landing craft, infantry.)

Experiments were also under way on larger vessels. The Navy was working on a vessel capable of landing light Marine Corps tanks. The fall of France in 1940 made it apparent that Europe would have to be invaded from the sea—which called for landing ships much larger than anything previously built. The British Navy reached similar conclusions. So British and American naval architects and engineers put their heads together. They decided on a giant vessel, capable of crossing an ocean under its own power and yet able to run into the surf and discharge its cargo. This called for deep draft under the first condition and shallow draft under the second—a real problem in ship-building.



Right, Navy's amphibious "water buffalo," shown in action at sea and on land. Below, two LST's unload on an island in the Solomons





In October, 1941, the first of such ships was sketched on paper and in July, 1943, it was used in the Mediterranean. It was called an "LST," meaning "landing ship, tank." It could carry not only tons of tanks, but hundreds of troops, ammunition, gasoline, artillery or smaller landing craft. When it ran into the shallow surf and discharged its cargo through its opened bow doors, it looked like a stranded whale with its mouth open.

Getting thousands of landing vessels built—ranging from three-man lifeboats to the giant LST's—was a stupendous task. Already American shipyards were running at near-capacity. How were men and materials to be made available for this new program which ran well over \$1,000,000,000? Yankee ingenuity and slashing of red tape came to the rescue. Contracts were made by telephone or wire. Special priorities, over-riding everything else in the war production program, provided critical materials.

In some cases the Navy turned to heavy industries along inland waterways—such as former



Sailors grab forty winks aboard invasion ship; note helmets and life jackets. Below, landing vital supplies along beach







Flotilla of LST's lined up along the docks takes aboard men and supplies. Destination—an enemy shore

bridgebuilders — experienced in working with iron and steel products but totally inexperienced in ship construction. In addition, new facilities were constructed almost overnight in former corn fields, vacant lots and abandoned buildings along lakes and inland streams. Thousands of persons who probably never had seen sea-going ships were hired, quickly trained and set to work. Some contractors even started prefabricating work in tents.

One important factor was the enthusiasm

of the workers. They shared one of Uncle Sam's most closely guarded secrets when they were told "you're making invasion boats." They kept the secret and worked all the harder. Soon a steady stream of new invasion vessels began to flow toward naval bases.

No mistakes were permitted. Basic designs had to be correct, for there was no time for thorough tests. They had to be simple, for mass production was needed. The yards and builders had to come through without delays.

At the same time that invasion ships were being assembled, the Army and Navy had a joint training program under way. On the Pacific Coast under Rear Admiral Francis W. Rockwell, and on the Atlantic Coast under Rear Admiral Alan G. Kirk, Army and Navy men were being welded into a powerful striking force. A new kind of fighting man was being developed



Towing invasion troops toward hostile shore in rubber boats



—neither a soldier nor a sailor but an "Amphib."

Amphibs are not commandos, although they have learned many tricks from them. Commandos strike swiftly, accomplish their mission and leave. An Amphib hits the beach and hangs on like a bulldog so that regular troops may pour ashore later.

Because of the extremely complex nature of amphibious operations, the training program is tough, broad and intensive. Every officer and enlisted man is hand-picked. He must not only understand his own task, but the part that will be played by other units involved. Differences in Army and Navy terminology must be ironed out so thoroughly that there will be no misunderstandings when the bullets start whizzing overhead.

Preparation for amphibious warfare falls into four general phases: (1) The indoctrination of commanding officers in the strategy, tactics and techniques of joint operations, (2) the training of many specialists needed to carry out smooth landing operations, (3) basic training in the use of highly specialized amphibious equipment, and (4) advanced training which consists of practice landings of all units under simulated battle conditions.

Naval officers selected to command the invasion boats are taken from the fleet and midshipmen's schools on the basis of outstanding records and physical condition. Enlisted men are chosen from naval training station "boot camps" and specialist schools by the same yardstick. The result is a careful screening of a group of smart, enthusiastic, tough young men—capable of meeting the extraordinary demands of a dangerous assignment.

Some learn to maneuver the large LST's which carry tanks, or field guns; others are assigned to smaller landing craft that bring the waves of assault troops and their equipment right up on the beach; still others work with the Army specialists who establish the beachheads.

At the same time the Army selects units which have already had thorough training in the infantry or armed forces and assign them

(Continued to page 152)

*Boeing Aircraft Co.  
Seattle, 14, Wash.*

## "Sand Man" in a Diver's Helmet Blasts "Fortress" Parts

71823

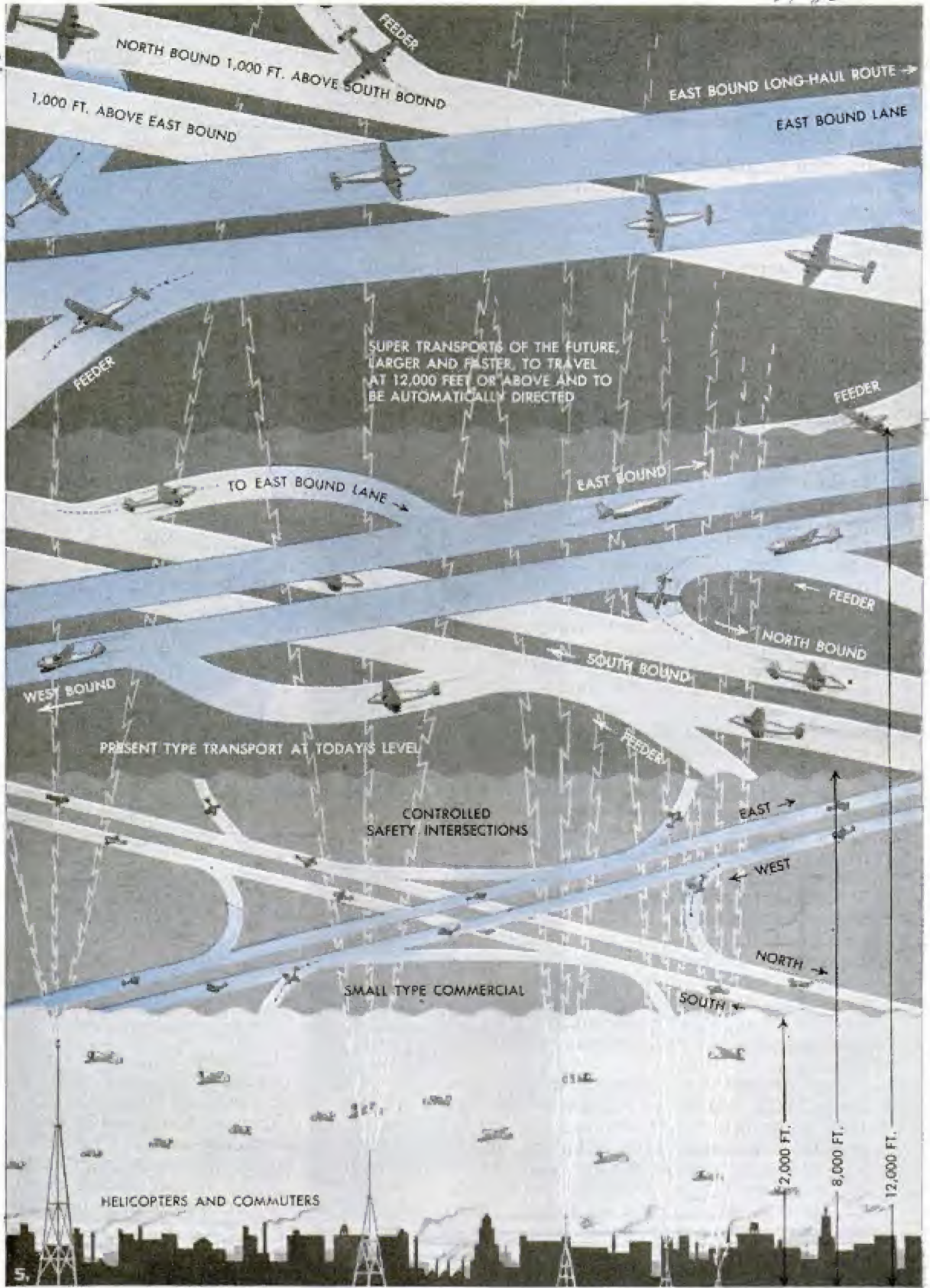


Helmeted like a diver, Boeing worker (top) cleans Flying Fortress engine mount. Below, window protects sandblaster at work

Sand of the Sahara has ruined many an engine, but sand also helps build the engine mounts for the Flying Fortresses. In a veritable tornado of flying sand, Boeing Aircraft workmen, dressed in divers' helmets for protection, sandblast the engine mounts to cut off the glassy flux left from welding operations. Other metal parts are also sanded free of scale and tarnish, the workman thrusting his arms—protected by canvas sleeves and rubberized gloves—into the chamber to guide the nozzle while he watches the operations through a glass window.

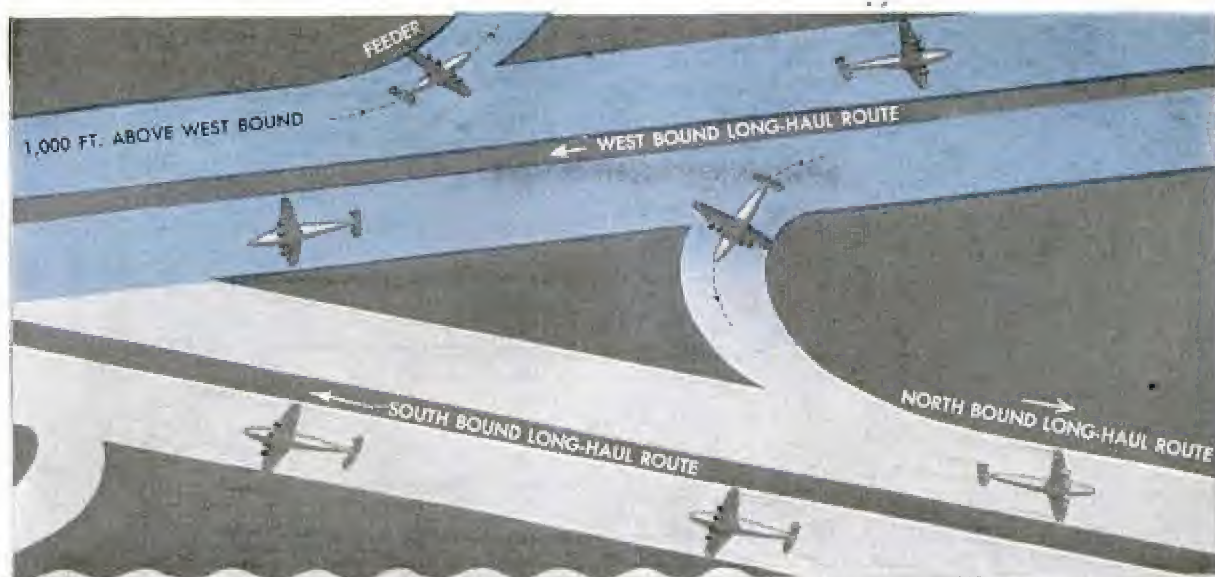
☐An alloy that is harder than structural steel is composed of two parts of the lightest metal known—beryllium—with 98 parts of copper.





Once the skies seemed an open thoroughfare unlimited in capacity for air travel. Today they are congested to a point where some airports handle close to a plane a minute. In this drawing the artist visualizes the separation of future air traffic at altitudes governed by direction, type and destination as conceived by author





# AIR HIGHWAYS *of* 1950

By William A. M. Burden

Special Aviation Assistant to the  
Secretary of Commerce

**B**ASED upon reliable forecasts, the Civil Aeronautics Administration estimates the number of air carrier passengers at 20 million per year by 1950. In addition, the low-cost family airplane is a certainty and a few years after the war, we may expect 300,000 private aircraft. It would appear advisable to plan for handling 500,000 aircraft, civilian and military, by 1950.

Movements of this number of airplanes are estimated between 53 and 60 million annually, approximately five times the present traffic. Obviously steps must be taken to avoid traffic confusion, delays and accidents. So studies have been initiated looking to speeding up traffic control by means of automatic machines at airways centers, improved radio facilities, anti-collision devices, automatic position reporting devices, ground station aircraft detectors and similar items.

Many of the present manually performed operations in a CAA traffic control center will introduce increasing delay to aircraft operating on instrument flight plans. The present communications system for handling flight data has a definite limitation due to the necessity for personnel to transmit, receive and manually transcribe the information. Many devices are already being installed to simplify the handling of weather transmissions. However, the hu-



"Traffic cops" direct arrivals and departures in a CAA tower

One of busiest control towers is at Washington, D. C.





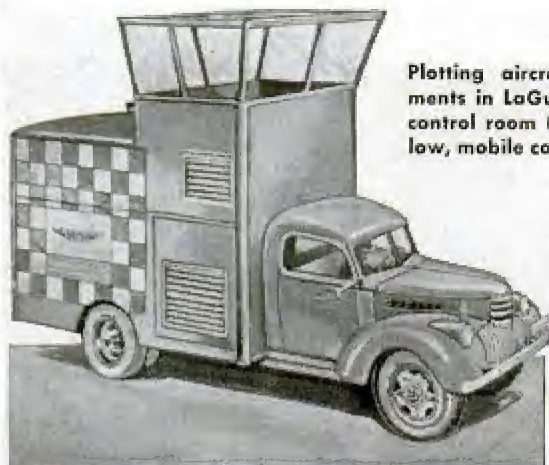


Every plane on a Federal Airway in the area under his jurisdiction is spotted on map by the CAA traffic controller (left). The tape at right brings in weather data and other flight information on the CAA Teletype

man element is still present in the manual posting of data on flight progress boards at the control center. This human element introduces problems in possibility of error and speed of handling messages.

As far back as 1938, it was considered essential that transmission and presentation of flight information before control personnel be effected mechanically rather than by posting manually. The first system of automatic posting was installed in the Washington Airway Traffic Control Center in 1941. This installation, forced out of service by great increases in traffic, served as the basis for study that has resulted in plans for an integrated automatic communication and posting system.

The system will comprise a network of printing telegraph circuits linking control centers to each other and to the sources of data — airway communications stations, airline radio stations, control towers and military operations offices. Flight data are



Plotting aircraft movements in LaGuardia field control room (right). Below, mobile control tower

posted automatically and directly to flight progress boards—rows of electrically rotated drums similar to the stock quotation boards in brokers' offices. Numerals on the surface of the drums display the flight information. Thus, we may have a control room wherein the personnel, seated on raised platforms, view the boards from distances of five to 15 feet, eliminating obscurement of data by personnel doing the posting.

This system incorporates automatic features reducing tremendously the work of controllers. Signal lights will automatically



call attention to flights needing further approval; another warning will indicate flights not provided with sufficient altitude or time separation. Estimates of the times flights will pass over various fixes will be automatically computed and posted. Weather information also will appear. The system will be adaptable, also, to posting information directly from aircraft in flight.

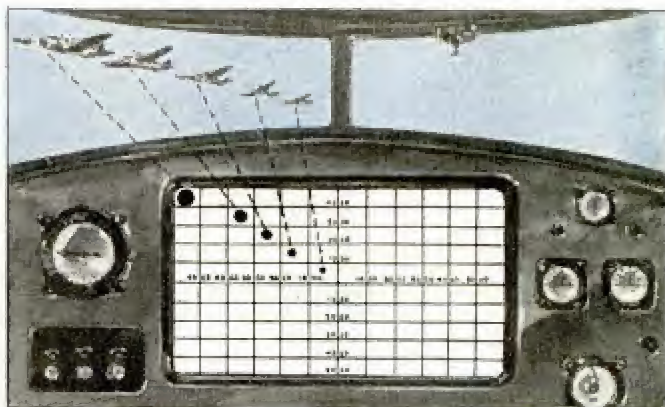
The CAA has devised a radio range free from disadvantages of present equipment, an Ultra-High Frequency Radio Range with two visual courses, or "legs." The range now used operates on a low frequency and the pilot flies along the "beam" by listening to a signal in his earphones. With the new radio range, the pilot can follow his course by a cockpit indicator giving in degrees his position on either side of the on-course signal. The effects of weather, static, fading signals and other defects have largely been eliminated.

The same difficulties have developed on our airways as on our automobile highways—through traffic is delayed by congestion of local traffic. The time has come to follow the example of highway engineers and route through traffic around points of congestion. When the CAA establishes the new system, the ultra high frequency radio ranges will be arranged to provide direct routes,

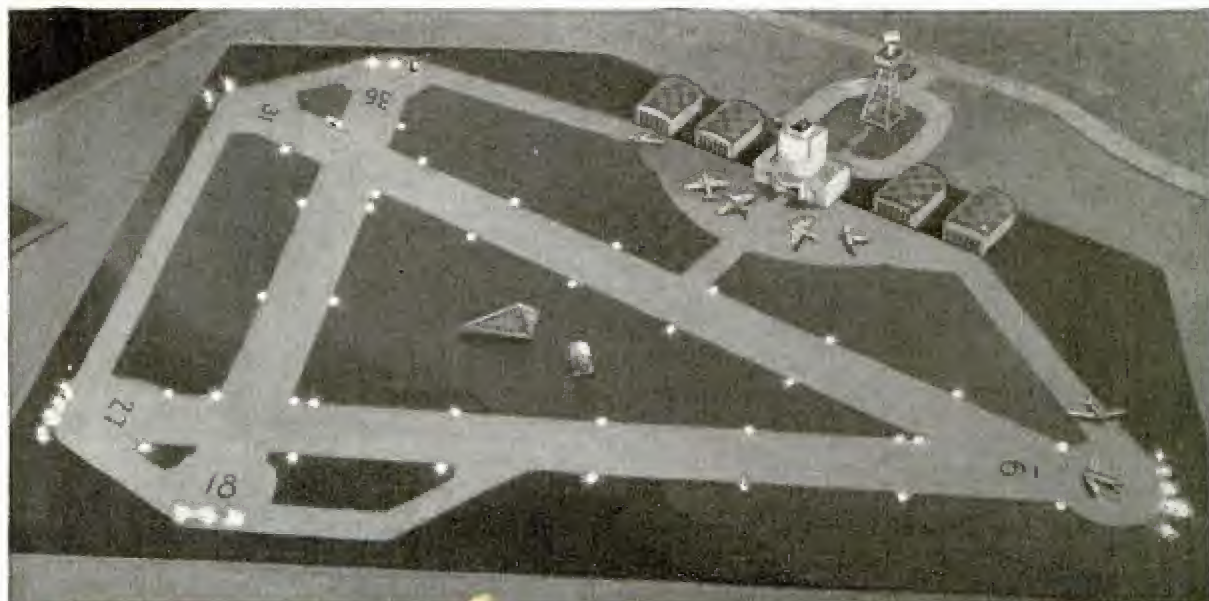
(Continued to page 154)



Proposed screens (above) would show horizontal and vertical position of planes near airport. Size and position of dots on cockpit screen below show proximity and position of other plane



Actual scale models of airports with planes on runways are used to train CAA traffic controllers. This one is at Atlanta





*Public Relations Officer*  
*IV Fighter Command, Oakland 4, Calif. 94627*  
**"Country Cottage" Slides Over Antiaircraft Gun**



If enemy aircraft attempt a bombing of the American shores, they may uncover unpleasant surprises, for Uncle Sam has been an apt pupil of this war's lessons as to the importance of camouflage. For example, one coastal spot is protected by a dummy cottage, which rolls away to reveal a 90-millimeter anti-aircraft gun. Crewmen of the gun, at left, use a block and tackle to move cottage out of the way



With the house wheeled back, the muzzle of the gun is free to rise to challenge the intruder, above. Homelike touches to this bit of deception include shutters painted on the wall, and the fence



But though it might resemble an innocent hearthside to an intruding plane, this is a house with something in the "basement" besides a furnace and a coal bin. Here, unroofed, is the sturdily emplaced anti-aircraft gun. Above, crewmen are ramming home one of the shells for the high-firing gun. At left, the entire crew in position to fire. One advantage to this installation is that, if the raid alarm is false, or if the raider is driven off, the cottage covering the pit can be pulled back into position, as rapidly as it was rolled away. Thus, the gun position is exposed to enemy view for minimum length of time



# "Necklace" Rings Harbor to Bar Enemy Ships

Wartime harbors would be rich hunting grounds for enemy submarines and surface raiders, were it not for the mammoth "necklaces" set across the harbor mouths. These are nets, strong enough to catch any enterprising raider. Members of the boom defense branch tow the nets to the harbor boom, and thus set up a seaborne barrier.



Nets form barrier to keep out enemy subs and surface raiders

## Supercharger Uses Water To Give Burst of Speed

Fighter planes are given a burst of emergency power with a water injection device attached to the supercharger. A jet of water introduced at the right moment in combat gives the engine an extra burst of power due to the vaporization in the cylinder. Also, the cooling effect of the vaporization is greater with water than with fuel, according to Pratt & Whitney engineers who developed the injector. It is operated by pressing a switch, much as a fighter pilot fires his guns.

## Farming Under Glass Adds Tons of Food to U. S. Larder

At least 150,000,000 extra pounds of vitamin-packed fresh vegetables will be harvested this year from gardens completely under glass. These are huge greenhouses, so extensive that plowing is done by horse, or even by tractor. One such unit near Cleveland, for instance, comprises 300

acres, and more than one wild duck, flying at night, has mistaken its broad stretches of glass roofing for a lake shimmering in the moonlight, and has made a disastrous crash landing. Under glass, one acre will produce 12 times the crop of the average outdoor acre. Soils three feet deep must

be constantly treated and revitalized. For one month each year crops are not grown on a particular tract, and the soil is then sterilized by a spray of steam from pipes three feet below the surface. Each acre requires from 400 to 600 tons of coal for heating, and at least \$25,000 an acre is the cost of setting up hothouse farming. But the rewards are great, for most of the crops are spaced so that they reach the market out of the normal season, and thus avoid the competition of outdoor crops.





*Mr. W. J. Banks, Am 306  
22 College St., Toronto, Ont., Canada 7185-2*

## AN OIL FIELD JOINS UP



**L**ESS than 80 miles from the Arctic circle, oil wells pour forth their black treasure to grease the skids under Tojo. Through 570 miles of pipe traversing the continental divide and hitherto unknown wilderness, oil will flow soon to Whitehorse on the Alaska Highway. There a new refinery has been built to turn the crude into fuel for the planes, ships and vehicles that will take the Allies to Tokyo the short way.

When the Japs pulled their fast one, men who knew the north became interested in the strategic value of the oil field at Norman Wells. By the Mackenzie river in Canada's Northwest Territories, more than 1,200 miles by river, lake and portage from the "end of steel," Norman's first wells were drilled 23 years ago. If that oil could be delivered direct to Alaska, it would mean a tremendous saving of time and transport.

A sub-arctic pipe line was something entirely new. It involved piping oil over the Mackenzie mountains, through bush, barrens and treacher-

ous muskeg, where the temperature drops to sixty degrees below. It didn't sound feasible. But Uncle Sam's army engineers, aided by American and Canadian civilian workers were ready to try.

The Canol (Canadian Oil) project began in Washington on May 20, 1942, when the war department contract was signed with Imperial Oil, Limited, owners of the wells, and other firms, architects, engineers and contractors. Supervised by the U. S. Corps of Engineers, the job was put under the jurisdiction of Brig. Gen. O'Connor's famed Northwest Service Command. Total cost to

Above, loading a tug on a barge for shipment down the Mackenzie river. Right, pipeline welder must have his smoke even with his helmet on







Left, swinging a length of drilling pipe into position at base of derrick. Right, a map of the 570-mile wilderness pipeline

Uncle Sam is estimated at \$138,000,000, but he'll get back part spent on the development of the oilfield itself through a 50 cent reduction in the initial price of the crude—\$1.25 a barrel—after the first 1,500,000 barrels have been delivered. Oil transported up there from U. S. fields would cost up to \$6 a barrel.

Within a week, key men were at Edmonton, Alberta, the control base, and 2,500 U. S. engineer troops were en route to Waterways, the rail end 300 miles farther north.

Transport was the major problem. Existing boats and scows on the Athabaska-Slave-Mackenzie river route couldn't begin to handle the freight needed at Norman Wells and Canol (new base camp across the Mackenzie from Norman) before the October freeze. Thousands of tons of pipe, material for dozens of new wells and storage tanks, prefabricated living quarters, supplies for workers and roadbuilding equipment all added up.

Construction firms formed an organization called Marine Operators, under

"Caterpillar" Diesel tractors hauled barges, Engineers' boats and pipe over 16-mile portage







Loading a plane on Mackenzie river at Norman Wells with supplies for geologists. The canoe will be lashed to the plane's pontoons

Matt Berry, famed Canadian bush pilot. He chartered everything that would float. A hundred prefabricated tugs, barges and scows were assembled at Waterways. Big barges were lifted bodily from the water and trundled over a 16-mile portage at Fort Smith. Missouri rivermen helped man the fleet.

Winter didn't stop the freight. From the railroad at Peace River engineers rerouted a 500-mile winter road to Great Slave Lake, which will become a permanent \$30,000,000 job. By February, 1943, tractor trains were rolling with supplies all the way to Norman, 500 miles farther, by a new pioneer road "bulldozed" through unmapped wilderness.

The men on the job regard the laying of the pipe as

the easiest part of the project. It simply snakes over the surface, sometimes sunk in muskeg, sometimes climbing a mountain. It allows for expansion and contraction in temperatures from 90° above to 70° below. Fortunately, Norman oil, high grade and of a paraffin base, will not congeal even at that minimum.

The real tough job on the Canol to Whitehorse stretch was roadbuilding. Roads torn through the sub-arctic bush along what appeared to be the logical route into the Mackenzie range, looked fine in winter. But when the thaw came they disappeared into the bottomless muskeg along with pipe and equipment. Surveyors had to map a new route which approaches the 5,000-



Above, a Texas oilman checks welded joints of Alaska pipeline. Left, U. S. Engineers' boats portage to Ft. Smith



foot plateau via a 24-mile-long canyon.

Already pipe lines carry gasoline delivered by tankers at Skagway to Whitehorse and to points along the Alaska highway. When Whitehorse begins to refine Norman oil it too will flow as far as Fairbanks. In all some 1,600 miles of pipe are being strung in the sub-arctic!



N 860

Designed by, not to be built by

# Two-Rotor Helicopter May Fly at 300 M.P.H.

Helicopters built with one or two rotors, some using jet propulsion, are taking form on the drawing boards of aircraft engineers. A speed of 300 miles an hour and comparatively unlimited ceiling are predicted for these helicopters of the future. They would be made of synthetic bonded plywood, plastics, and steel tubing. The single-rotor models would have the advantage of more economical construction and lighter weight than the two-rotor craft, but the latter would have much greater lift. Engineers at the Adel Precision Products Company, Burbank, Calif., manufacturers of hydraulic equipment, point out that the dual rotor ships would have to be constructed so that if one motor failed, the other would operate both drive shafts. Although most of the models are built to accommodate four persons, one military version provides for two pilots and four 200-pound depth bombs. Jet propulsion is believed to be the ultimate in helicopter development, but it will probably be sev-



Two designs for helicopters of the future; note two rotors on top model

eral years before this principle is successfully adapted. One design calls for a heat-expansion engine feeding propulsion jets in the rear upper surfaces of the rotor blades.

N 779

## "M.P.'s" Roll Away From Tank in Toughening Course



Uncle Sam's military policemen are toughened for their duties by a rigid training program, one detail of which includes a "game" in which they play cat-and-mouse with a tank. Lined up recumbent in pairs, directly in the path of the rushing tank, the men lie quietly until the vehicle is almost upon them. Then, at the last split-second, they dig in toes and elbows, and roll out of the tank's path.

Soldiers roll from path of advancing tank—second to spare

Military Police of 7th M.P. Battalion  
Canton, N. Y.



# MORE

# DEADLY



The "welding conditioner" at top sucks fumes away from welder's face. Below, safety styles for a girl riveter—headgear, mask, short sleeves and "hard" shoes

Top photo, Lincoln Electric Co.; lower, National Safety Council



**S**UPPOSE America's entire war production shut down and the wheels on the home front simply stopped turning for seven days and seven nights.

Incredible as it may sound, this happened in effect in 1943. Yet it made no newspaper headlines, for strikes, sabotage, catastrophe or peace was not the cause. What actually happened was that American workers were not on their jobs for 350 to 400 million man-hours during the year for one reason alone—industrial accidents. With 50,000,000 workers engaged in war production, this is the same as seven to eight days lost for every one.

Accidents, in fact, proved a greater enemy than the guns of the Axis, or disease. In the first 16½ months of the war, casualties in the U. S. armed forces were 12,123 dead, 15,049 wounded and 51,063 missing or prisoners or interned—a total of 78,235. But casualties to American workers through accidents in the same period were 64,500 dead and 6,000,000 injured, on or off the job, the National Safety Council reports. Of course there are many more millions at work on the home front than in the battle lines, but in total figures, industrial casualties far exceed war casualties.

Despite these startling figures, there are two bright spots in the picture. One is that deaths from occupational mishaps decreased slightly in 1943 compared to 1942, according to estimates, and this is in the face of a substantial increase in employment. In 1942 industrial accidents cost 18,300 on-the-job deaths, 500 more than 1941.



# THAN WAR



The second encouraging factor is that war-worker deaths are running considerably below the rate in World War I. Available information indicates that in 1917-18, deaths per 100,000 workers were nearly one and one-half times as numerous as in 1941-42.

These figures speak well for the progress in industrial safety methods between wars. But the strides made since the beginning of the present war program have so far surpassed anything in safety history that it would be almost impossible to calculate how much productive manpower has been saved.

If this appears paradoxical, considering the vast total of man-hours lost, it must be remembered that industrial employment is at the highest point in history, that more workers than ever are engaged in munitions production and other hazardous occupations, that there are vast numbers of inexperienced workers—women and girls, boys, men as old as 85, persons physically handicapped; and that even experienced workers are doing new jobs and operating equipment with which they are not familiar.

Because of these factors, safety engineers declare that, actually, an outstanding safety record is being made by American industry. Part of the credit is given in industrial management and



At home or in the plant, falls are the most frequent cause of injury

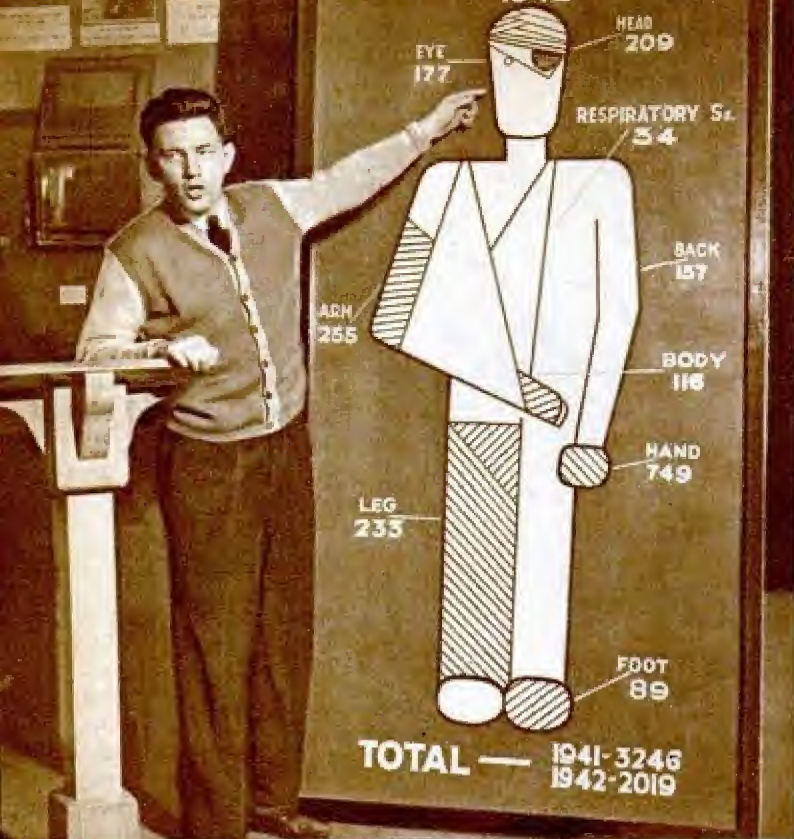
Machines and neckties don't mix, U. S. Rubber tells men in TNT factory

## These Neckties are **SAFER** on this board!

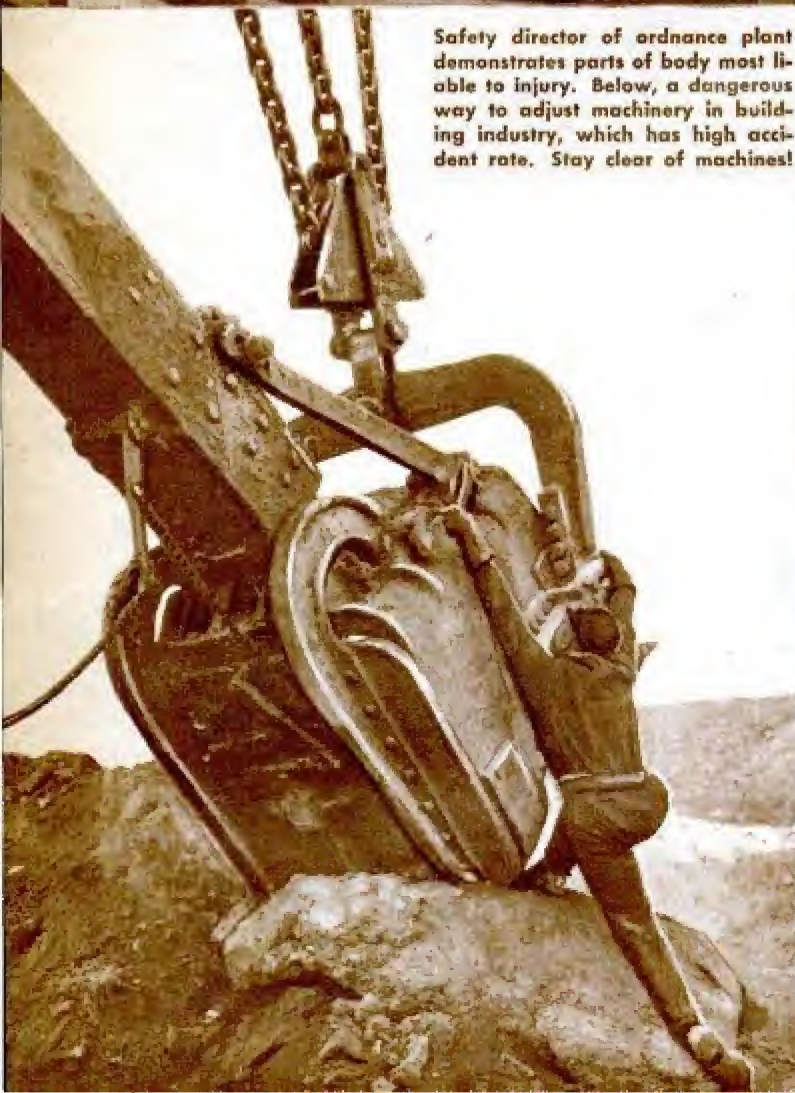




# INJURY EXPERIENCE PART OF BODY AFFECTED 1942



Safety director of ordnance plant demonstrates parts of body most liable to injury. Below, a dangerous way to adjust machinery in building industry, which has high accident rate. Stay clear of machines!



the workers themselves for the safety programs developed, and part goes to designers and producers of new types of safety equipment.

Women in war plants are equipped with safety headgear of many types, clear-vision goggles or face shields, acid or dust hoods, gloves, hand pads, aprons, body shields, safety or flame-proofed arm guards, safety shoes or foot guards. Many old-type safety shoes were well insulated to protect the wearer against electric shocks. Now, however, most of such shoes are made so they will conduct static electric charges from the body to the floor and thus prevent sparks which might lead to disaster in munitions factories or plants with dust-laden atmospheres or other explosion hazards.

For many years, goggles were a bugaboo to industrial workers. They were uncomfortable, interfered with vision, or were hard to keep clean. But face and eye protection is so vital that goggles have been redesigned, shields of transparent plastic have been substituted, special goggle cleaning stations have been installed at convenient factory locations. Too, it has been found that glycerin is a valuable addition to goggle cleaning solutions. Regulations covering the wearing of goggles are rigidly enforced throughout industry with remarkable reductions in eye injuries. The Pullman Standard Car Manufacturing Company, makers of railway cars, tanks and patrol boats, has a strict rule that every person entering any factory for any purpose must wear goggles. This applies not only to the workers but to executives, visitors and office employees.

Painting plant interiors and machines in contrasting colors not only has helped production but has decreased accidents through what the experts call "three-dimensional seeing." Instead of having drab walls and ceilings and dull finished machines, some 250 companies have repainted factory interiors and machines in scientifically selected colors. Walls and ceilings thus have become light reflectors instead of "light robbers." Machines have been refinished in color combinations. For example, the over-all color of a machine may



be horizon gray and the working areas spotlighted in light buff. The man operating the machine can see what he is doing more clearly and without eyestrain.

Safety training has become an integral part of virtually all pre-employment or pre-production courses throughout industry, and this has extended to vocational schools, college shops and government departments. In welding, for instance, trainees are taught not only how to handle their torches safely, but how to guard against fire, explosion and toxic dangers.

Among the first government



Top, worker wears gas mask to inspect inside of tank car which carried chemicals. Left, plastic-metal face shield is worn on explosive line at ordnance plant. The shower below gives first aid for acid burns. Lower photos from U. S. Signal Corps.

units to recognize how much accidents hold up war production were the Maritime Commission, and Navy Department. Early in the war, the commission and Navy, working with the National Safety Council, instituted a safety campaign in more than 200 shipyards. More than 100 yards are competing for semiannual safety awards based on monthly reductions in accident rates. J. M. Roche, director of the industrial division of the council, says latest available figures show the accident rate in shipyards has decreased steadily to a point where it is more than 15 percent less than in 1942. He declared that in 1942 nearly 100 more Liberty ships could have been built had it not been for the lost

(Continued to page 148)

MARCH, 1944





7753

## "Mechanical Eye" of Tester Reveals Faults in Gears



Portable tester shows any variation in gear teeth

Faults in precision gears are quickly detected with a portable tester of vertical construction that occupies little bench space. It shows up rolling action between two working gears, or gear and pinion, and reveals variation in gear tooth thickness or errors in spacing. It is also used to check gear train assembly. Center distance is accurately checked by setting up the instrument to the proper distance with gage blocks or standards. The master gear is placed on an arbor and the gear to be tested is placed on another arbor directly in contact with the master. The tester can be adjusted to any precision required from .001 inch to .0001 inch. It has a range of 1 inch to 6 inches center distance, with special attachments available.

## Vibration Explodes Torpedoes Guided by Magnetism

German U-boats, operating in packs that suggest organization similar to that of a surface fleet, have introduced a new and deadly type of torpedo. Navy authorities say it combines magnetic guidance with acoustic detonation. Fired at a ship from astern, it overtakes the surface vessel, presumably being guided magnetically. Once within the radius of the vibration from the ship's propeller, it explodes. With the ship's running gear thus disabled, it is an easy mark for a pointblank torpedo. Re-

connaissance photographs suggest the "fleet" type of organization, with the probability that various U-boats are designed for different functions. One photograph shows an enemy submarine with perhaps ten guns firing from the deck. Presumably it was fitted out to provide antiaircraft protection for the entire wolf pack.

## "Power Station" in Big Bomber Takes Load Off the Engines

Compact generating plants for airplanes are powered by a 93 horsepower engine in a fire- and sound-proof compartment no larger than the hood of a small automobile. Housed in the fuselage, this "flying power station" is operated by remote control. It furnishes the power for lowering the landing gear, operating turrets, and for various lights. This independent unit will operate when a plane is stationary on ground or water, and is an additional safety measure in case of crash landings with the driving engines out of action. British engineers, who developed the plant, believe it will increase flying range by taking some of the load off the engines.

## Single-Cup Drip Coffee Maker Can Be Used at the Table

You can brew your own coffee at the table with a drip device resembling a glass cup with a removable bottom. A filter fits around the bottom section. A rim around the base makes it possible to set the "drip cup" on any standard size cup.



Filter fits around removable bottom section of cup

The Jiffy POPULAR MECHANICS  
Drip Co., 2112 Washington Ave.  
N. Y., N. Y.

George W. Scherer Co., Inc.  
128 Lafayette St.  
N. Y., N. Y.

7758

used by Siemens

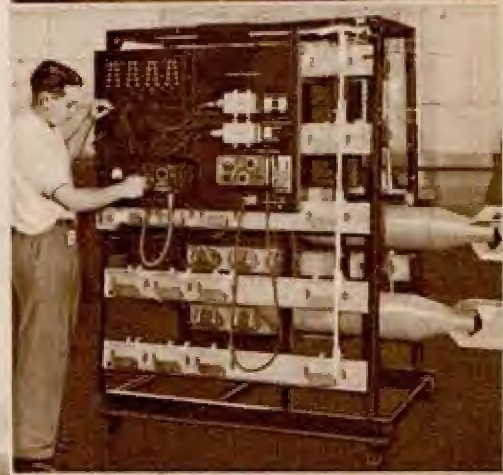


*Army Air Forces Materiel Command  
Wright Field, Dayton Ohio 731*

# FIREPOWER by the TON



With the advent of the 75-millimeter aircraft cannon our Air Force is more than ever the "flying artillery." At Wright Field the Materiel Command has laid out in a dirt-embanked amphitheater a 200-yard target range to test aerial weapons destined to throw firepower by the ton at the Axis. The largest bombs now being tossed from our Fortresses are similar to the two-ton "blockbuster" shown above with a 100-pound demolition bomb—but bigger blockbusters are on the way. The fighter plane fuselage at upper right was put on the target range one day to try the penetrating power of our aerial .50-caliber machine guns. They turned it into a sieve. At the right, an Air Force engineer tests a bomb rack loaded with hundred-pounders. The same rack can carry bombs of any size; one three-pound shackle will support one ton



Resembling a giant amphitheater is this 200-yard firing range at Wright Field, where nose cannon of plane, and turret mounted on truck (right) are being tested



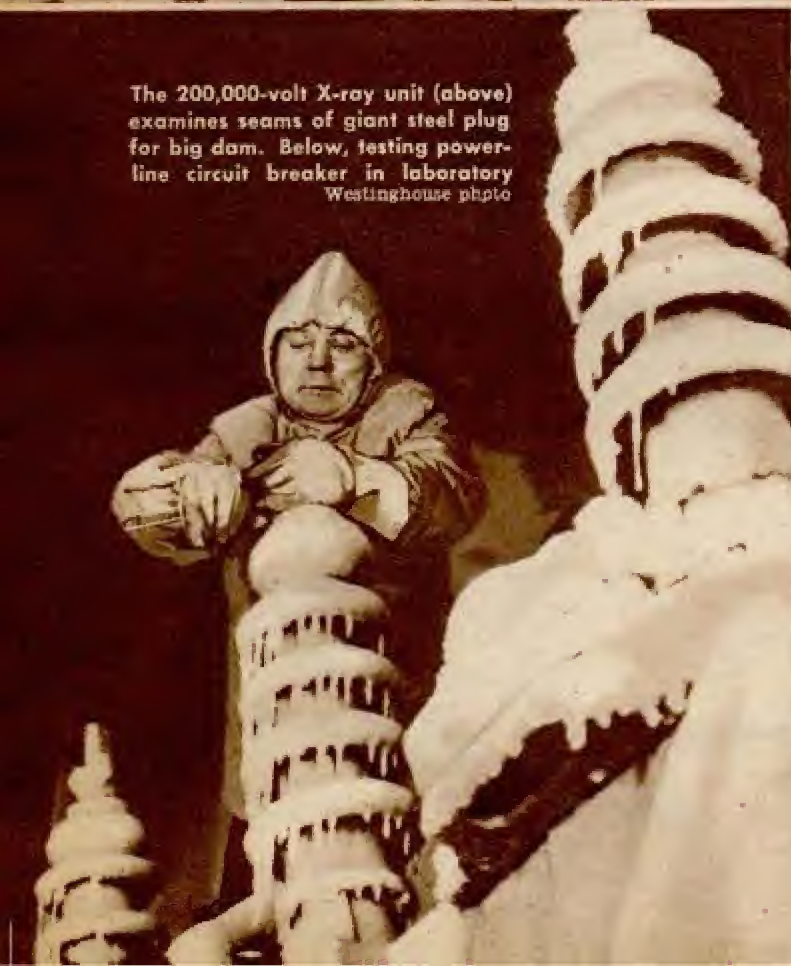
# GIVING TOOLS *of* WAR *the*



Photo courtesy General Electric

The 200,000-volt X-ray unit (above) examines seams of giant steel plug for big dam. Below, testing power-line circuit breaker in laboratory

Westinghouse photo



**O**N FIGHTING fronts, in government arsenals and proving grounds, and in the nation's war plants, new species of wartime detectives are helping beat the Axis.

Though their methods and tools would put a modern Sherlock Holmes to shame, these sleuths are not intelligence officers nor G-men. They bear the insignia of the Army and Navy Ordnance departments. They are metallurgists, chemists, inspectors, spectrographists, experts in any detail having to do with the quality, performance and serviceability of American battle equipment.

Their job is one of investigation. They start with captured enemy equipment, testing and examining it with nth degree thoroughness and comparing it with equipment of the Allies in every detail. And their work is not complete until they have made sure, through intricate inspections, not only that American equipment is superior to that of the enemy, but that there



Mr. C. H. Moore 77616  
1362 N. Dearborn  
Chicago, Ill.

# THIRD DEGREE

is not the slightest flaw in design, material and workmanship.

"Detecting" begins simultaneously with battle action. Advancing with the fighting men, Army Ordnance experts seize samples of captured equipment, snap pictures, take measurements or make estimates from their own specialized knowledge of each likely piece of Nazi or Jap ordnance to come within their reach. The results of their studies are rushed to the United States, and the objects of their examinations are shipped to America for further analysis.

The booty of these Ordnance investigators ranges all the way from entire cannon and tanks to microscopic particles measured in terms of millionths of a pound. Every bit of metal, oil, powder or chemical that falls into their hands is made to tell its own story. These stories often reveal enemy material shortages existing or overcome, weakening armor or deterioration of quality or workmanship.



Courtesy Stewart Warner Corp.

Magnifying machine checks trueness of screws by projecting image 50 times size of object on screen. Below, inspectors give German tank the "third degree"







Jacketed lead bullets pass under the critical eye of trained inspector

If the modern Sherlock Holmes frowns on the third degree, the Ordnance department does not. In seven testing centers in this country, captured war paraphernalia is subjected to scientific and rigorous examinations. Samples of every type of cap-

whether blind spots exist.

Watertown Arsenal in Massachusetts is the principal ferrous metallurgical laboratory of the Ordnance department. In a single month this laboratory makes more than 30,000 tests—chemical analyses, tensile and micrographic tests, radiographs.

Picatinny Arsenal cross-examines enemy propellants and explosives to find out what ranges the enemy guns are getting and how best to combat new armor-piercing or anti-personnel explosives. Fuels and lubricants are tested at the Rock Island Arsenal, and the Watervliet Arsenal and Springfield Armory have special testing departments.

Ordnance "G-men" of the Navy likewise have their proving stations. One of the most famous of Navy proving grounds is at Dahlgren, Va., where all kinds of guns, from .50-caliber machine guns to the 16-inchers of a battleship's main armament are constantly booming over the Potomac River. Every gun for a Navy ship is proof-fired before it is installed. If anything goes wrong, it will happen on the test range, not in battle.

Ordnance investigators also see that the products of thousands of war plants maintain rigid standards, and work closely with factory engineers and inspectors in

Million-volt industrial X-ray unit is looking for invisible flaws in castings



POPULAR MECHANICS



making improvements which reduce to the minimum the chances of flaws in material and workmanship.

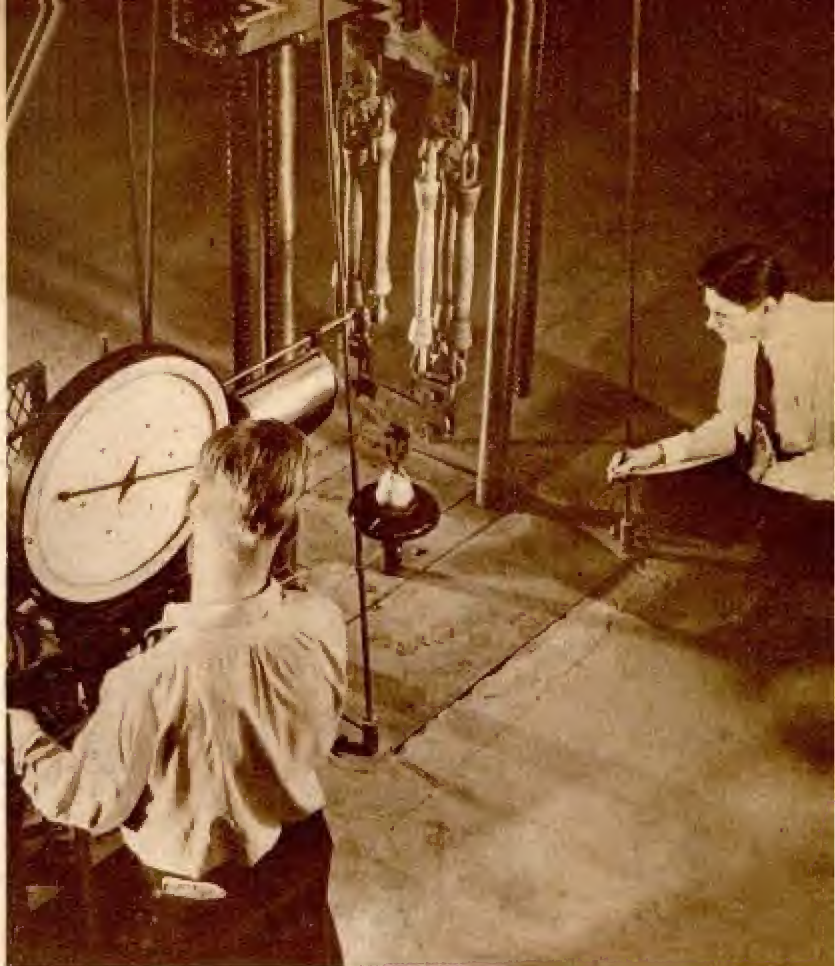
The Ordnance department uses gages that measure down to a hundred-thousandth of an inch. The Chicago Ordnance district alone has issued more than 30,000 gages to its inspectors.

Armament and munitions makers have made valuable contributions to Ordnance testing procedures. The few visitors at one plant are surprised to see small arms shells bounced on a small anvil and then accepted or rejected according to the color of a light which flashes with the impact of the shell on the metal surface. They would be even more surprised if they knew this inspection test was patterned after a development in the design of coin-operated vending machines which reject slugs by means of mechanism actuated by vibrations and sound waves. The munitions maker of today was the coin-machine maker of peacetime.

Testing of alloy steels is a highly important phase of war production, for there are almost as many types of steels as there are machines. Armor plate must be hard enough to stop projectiles; then the latter must be made still harder to pierce the armor plate. Shell cases must be elastic to facilitate withdrawal from the gun, and gun barrels must have great tensile strength. Thorough tests with the industrial X-ray have been developed for all these alloys.

Great progress has been made since the start of the war in the penetrating power, speed of operation, and maneuverability of giant X-ray machines ranging in power up to 1,000,000 volts. Portable million-volt apparatus now will detect flaws in steel up to eight inches in thickness. X-ray inspections have been reduced to minutes or seconds instead of the hours frequently required. Only

Ordnance workers checking range finder and telescope



Westinghouse engineer "umpires" a tug of war between a porcelain insulator and a machine that tears objects to pieces

a short time ago, Westinghouse announced equipment that brings assembly-line speed to radiograph examinations of airplane castings. This machine inspects six castings every 30 seconds, and is capable of

(Continued to page 148)



Signal-Corps photo



*Ultramar*  
303 W. Monroe St.  
Chicago 6, Ill. 77858

## Step Ladder for Light Repair Is Also a Rolling Cart



Ladder holds replacement parts for light fixtures

Designed especially for the servicing of fluorescent light fixtures is a step ladder, available in heights from 6 to 12 feet, that is also a cart for transporting replacement parts. When folded it rides on casters, and its compartments hold numbers of parts, tubular fluorescent lamps, and cleaning material. It is especially intended for plants and other buildings with numbers of fluorescent fixtures.

## Electronic "Watch Dog" for Pilot Keeps Eye on Many Instruments

Keeping tab on the array of flight instruments in the cockpit of an airplane is made easy for the pilot with an electronic device that reports when things go wrong. The indicator, known as a "flightray," uses a cathode-ray tube to show when an instru-

ment deviates from normal operating conditions. On the screen of the tube, "traces" are projected representing instruments such as the directional gyro, gyro horizon, air speed indicator, altimeter and cross pointer meter. When the traces move from a normal zero position, the pilot can tell immediately where the trouble is.

## "Bookkeeper" for Thunderbolts Keeps Tab on Lightning

Lightning strokes that hit power lines are recorded with an electric "bookkeeper" no larger than a playing card. The device, invented by a Westinghouse research engineer, consists of a transparent plastic "sandwich" with two strips of metal foil for filling. When lightning strikes a power line, part of the thunderbolt's current is side-tracked into the counter and when it jumps from one foil strip to the other leaves a black spot on the clear plastic.

## Detachable Hooks Remove Tire By Increasing Leverage

To force the bead of a big tire away from the rim, use is made of detachable hooks. One such hook is fastened to the bead-loosening tool and forced, by leverage, between the tire iron and the rim. This exerts a tremendous downward pressure on the tire, forcing the bead away from the rim. The procedure then is repeated on the other tire iron, and, if the bead still has not been loosened all around the tire, the operation may be repeated.



Forcing detachable hook between tire iron and rim

*Sperry Gyroscope Co.*  
*Sperry Bldg.*  
*Brooklyn, N.Y.*

*W. J. McCollister*  
*POPULAR MECHANICS*  
*Firestone Tire & Rubber Co.*  
*Akron, Ohio*



## Railroad Car "Built for Two" Has Foot Pedals

Yankee soldiers advancing through Sicily came upon one railroad track on which reposed a vehicle that greatly resembled, in its action, a tandem bicycle—except that the twin seats are side by side. Conventional pedals and chain drive propel the car, which is mounted on flanged wheels, and equipped with a hand brake. The Yanks took over the vehicle for Allied use.

Two Yanks and the railroad vehicle of unusual design which they found abandoned by the Italians in Sicily. It is pedaled like a bicycle and has a chain drive



## "Welds" Made With Paintbrush Support 107-Pound Load



With only one coat of synthetic resin, which can be applied with a paint brush, materials are "welded" into durable bonds. The resin unites metal to metal, metal to rubber, wood, leather or plastics, or any of these materials to each other. A special type is used for the metal to metal process which requires mild heat and slight pressure. The bond has been tested under temperatures from 50 to 300 degrees F., and supports a 107-pound load. When used to join rubber and metal, its adhesion strength is 1,200 pounds to a square inch.

## Hollow Freight Car Axle Saves Tons of Steel

Axles for railroad cars made of seamless steel tubing are expected to save about 65 tons of steel a day, or more than 20,000 tons a year. The hollow axle, developed by the Pittsburgh Steel Company, is said to have 56 percent greater resistance to bending than solid steel axles and will wear three to four times longer. Cost of hauling dead weight is reduced, for the new axle for a 50-ton car weighs 260 pounds less than its predecessor.

Materials "welded" with coat of resin support weight of girl

MARCH, 1944 "Pearlite"

Pittsburgh, Pa. 77



# The GAME of the MAGIC BROOM



Curlers use broom handles to measure distances of stones from button

**I**F YOU think a curler must be a hairdresser and a broom is only a household sweeper, you are not familiar with one of the fastest growing winter sports in America.

That sport is curling, a game of old and honorable heritage. It might be called a cross between shuffleboard and bowling—on ice.

Curling is a major sport in Canada, Scotland, Switzerland and other countries. Though played as early as the 1860's in upper New York state, and in the gay nineties in Chicago, it is only recently that curling gained a strong foothold in the United States.

This winter, the number of curlers in this country was greater than ever before. Country clubs in many large cities have taken up

Photos from Chicago Sun  
Here the "skip," or captain, is using his broom in the path of stone





the sport. Throughout Wisconsin, Minnesota, and other northern states, both indoor and outdoor curling are played with growing enthusiasm by old and young, men and women. International matches are played between America and Canada. Even in the heat of July 4th, 1943, a major curling tournament or "bonspiel" was staged in the St. Paul, Minn., municipal indoor skating rink.

It is easy to learn the fundamentals, easy to play, though practice and aptitude are required for proficiency as in most sports. The main qualifications are a good sense of balance, rhythm, lack of muscular tension, and consistent practice.

The only requirements for a curling match are a sheet of ice, 46 yards long and 14 to 18 feet wide, properly marked at each end; two standard circular curling stones per player, and a broom not unlike the common household variety. Most devotees of the game wear tam-'o-shanter headgear, or balmorals, as a mark of proud identification.

To understand curling, picture first the 46-yard "sheet" of ice. At each end of the sheet is a twelve-foot circle, its center midway between the sides and four feet from the end. A small round area at the center is called the tee, or "button," or goal. Usually there are two other circles, four and eight feet in diameter, inside the twelve-foot circle, but these have no bearing on the game, except to facilitate measurements.

The only other outstanding feature of the sheet is the "hack." This is simply a depression in the ice or a raised wooden blocklike affair used for a foot support for the players in much the same manner as a baseball pitcher has his mound or "rubber." There are two hacks, one at each end of the sheet. The large twelve-foot circles are called the "houses."

Each player must have two circular curling stones, most of which are imported from Scotland. The stones are polished granite, about thirty-six inches in circumference, weighing from 34 to 44 pounds, and having an easy-to-grip metal handle on the topside. In certain parts of Canada, the game is played with "iron stones"—actu-



Standing in the "house," a team captain is directing the play of teammate about to deliver a stone from opposite end of sheet



Teammates of the shooter wield their brooms (above) in front of moving stones. Below, two skips watch a stone glide home  
Photo from Seignior Club, P. Q.







With broom in left hand, a curler sends stone down the 46-yard ice sheet

ally made of iron and weighing up to 60 pounds. There are iron stones for women, smaller and weighing only 25 pounds. But the "stone stones" are most popular, and cost from \$30 to \$60 a pair, representing the major item of expense for equipment.

The brooms are regarded as an essential part of curling, although various curlers have their own ideas of their exact utility. These are slightly larger and have slightly longer handles than the usual household

and every stone lying nearer to the tee than the best stone of the opposing side counts one point.

Each rink has a captain or "skip" who is virtual dictator of the entire play of his rink. Since the skip generally is the most expert, he plays last. While his three teammates play their stones, the skip stands in the house or near the tee and directs the play, designating the shots and the positions where he would like the stones to come to rest.

Since a curling sheet is exactly the same at both ends, all eight players shoot first from one end, then reverse direction and shoot for the other end. Each time the two rinks complete the playing of their total of sixteen stones (two to a man), an "end" or inning has been played. A full match consists of eight to fourteen ends—usually twelve. The accumulative number of points won on each end determines the final score.

Sliding the curling stones is something of an art, and the action of the stones as they travel over



Looking down a Chicago club court as player delivers stone



the ice is what gives curling its name. With a slight motion of the wrist, a curler can give the stone an inward or outward twist that causes it to curve, or curl, as it loses speed. The action might be compared to the curve of a bowling ball. A proficient curler can curve his stone with great accuracy. Players slide the stones with an easy underhand motion, a good deal like bowling.

When a stone is started on its journey down the sheet, the three teammates of the shooter, all equipped with brooms, sweep the ice in front of it. This sweeping controls the rate and direction of the stone by polishing the ice, allowing the stone to travel farther.

Origin of the game of curling is lost in the mists of antiquity. References to the sport date back as far as the 16th century in Scotland. It was in the middle of the 18th century that a group of Scottish Highlanders stationed in Quebec thought of their native sport as a means of passing the long hours of a rigorous winter. Having no stones, they fashioned equipment from cannon balls, melting them down and casting them into a shape like a teakettle.

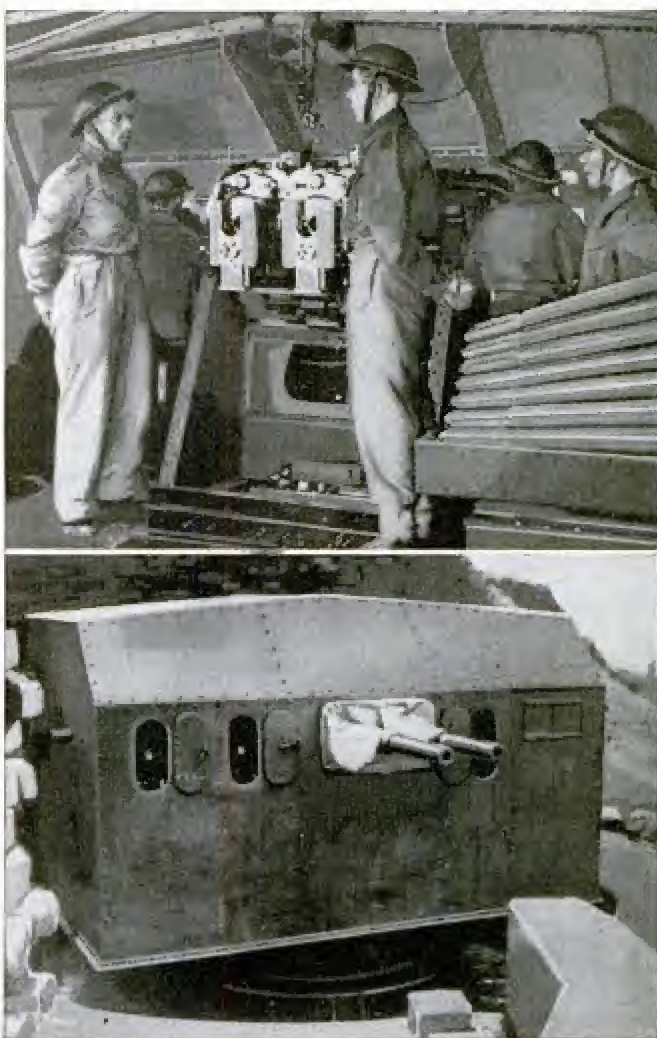
Organized curling clubs came into being in Canada in 1807. International matches with United States teams started in 1884 when Robert Gordon of New York presented a trophy to be played for alternate years in Montreal and the United States.

In sections where outdoor ice is available consistently throughout the winter, curling enjoys its greatest popularity. But the game is spreading indoors as more and more indoor rinks and "ice palaces" are opened. One of the most elaborate is in Milwaukee where the Milwaukee Curling Club and Wauwatosa Club play in a new \$150,000 establishment.

Upwards of 50,000 curlers in Canada belong to official clubs or associations, in addition to many unaffiliated "occasional" curlers.

Steeped in tradition, curling has brought many customs down through the years, one of them "stacking brooms" after a match. Stacking their brooms as soldiers stack rifles, the players proceed to the "curler's hut" or clubhouse, equivalent of golf's 19th hole.

## "Playhouses" Rip Invasion Craft With Twin Six-Pounder Gun



Top, inside of revolving gun turret; bottom, exterior view

Gun turrets about the size of a child's playhouse guard the shores of England, ready to pour a stream of death into small invasion boats. The turrets, which revolve in a circle of 360 degrees, house twin six-pounder guns. Their range is over 5,000 yards. The coast defense gun was used at Malta, and on one occasion destroyed eight Italian torpedo boats and five E-boats. Although the gun has the same caliber as the famous British antitank gun, they have little else in common for each was designed for a special job.

71922

## Strong Fiber Tape Replaces Steel Band For Strapping 100-Pound Packages

Laminated fiber tape, a substitute for steel bands or wire, can be used in all types of steel strapping tools for packages. It is water repellent, has a high tensile strength, and is said to be suitable for packages weighing up to 100 pounds. The tape is made in 450-foot rolls in three widths and two thicknesses.



## FORGING *for* VICTORY



General Electric hammer with 1,600,000-pound wallop (top) forges one-ounce supercharger blade or 25-ton metal piece. Below, lacquer spray tests a forging  
*Westinghouse photo*



**Y**OUR Uncle Sam is packing a concealed weapon these days, a deadly weapon so obscure that few have noticed the reassuring bulge on his hip.

This weapon is the growing number of giant forges, huge automatic hammers of war which, day and night with earth-rattling crashes, are pounding millions of red-hot chunks of metal into smaller, denser, tougher and lighter parts of the mechanical man-killing devices necessary for a nation's survival in modern conflict.

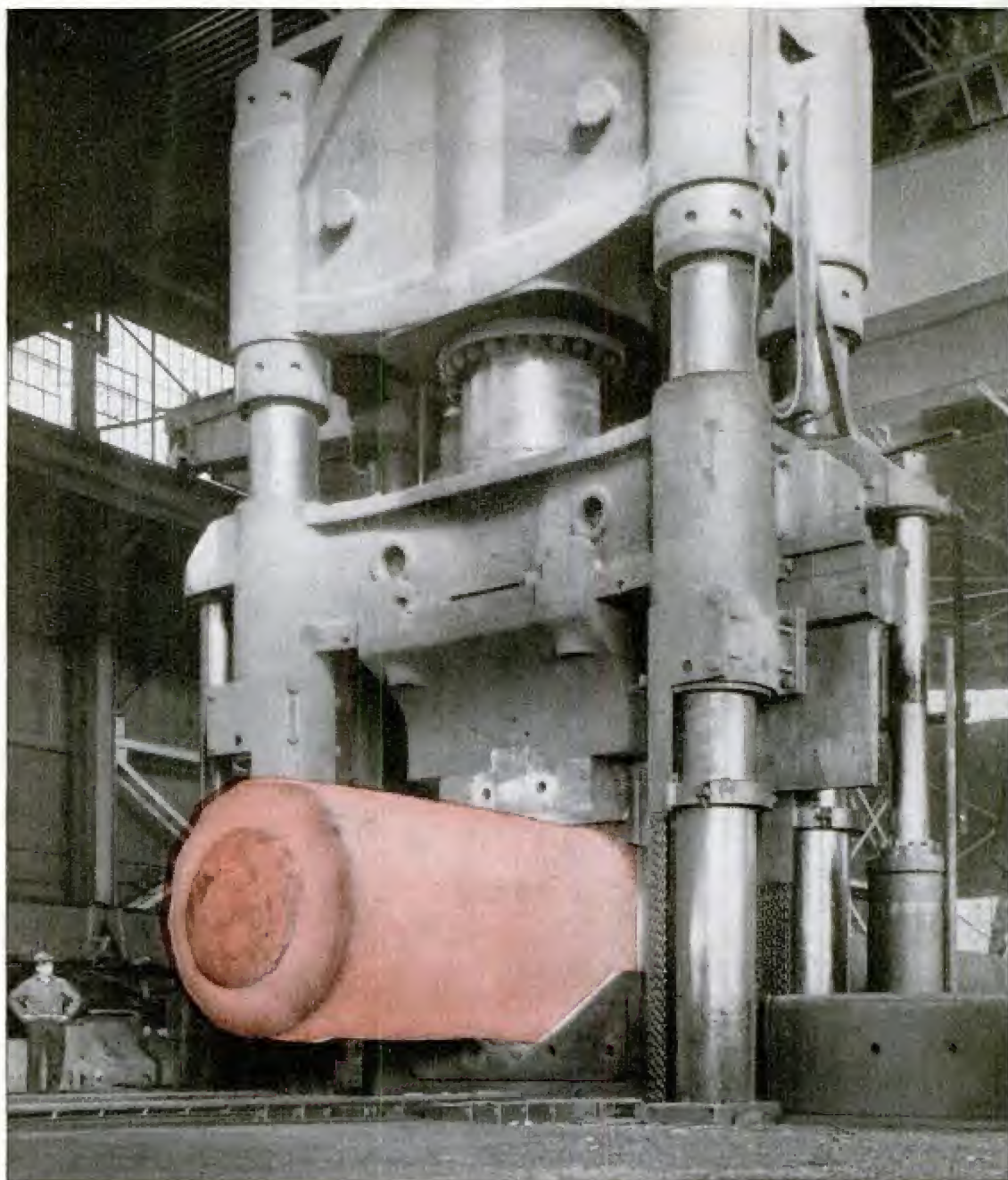
These massive machines in America's war plants are actually battering the Axis hopes of victory into the stained and littered soil of the world's battlefields.

For this age of speed has produced a war of speed. Speed in airplanes, tanks and battleships is largely the relation between power and weight. Forging reduces the size of a metal part while adding to its strength. Reducing the size of parts cuts the deadweight of the whole.

Thus, as the number of its forgings is increased, a bomber or fighter whips up its velocity another 50 miles an hour. A battleship plunges forward with an extra two or three knots. An antiaircraft gun can reach another 1,000 yards of effective range.

For example, a Flying Fortress contains more than 2,000 forgings. Its builders in the Boeing aircraft plants sometimes call it





**This hydraulic forging press squeezes steel casting with 6,000-ton impact at Mesta Machine Co., Pittsburgh**

the "Flying Forging." Yet, forging strength and efficiency into one single item—the aluminum cylinder heads of the engines—instead of casting gives this powerful bomber more than 10,000 feet of extra altitude. Nearly two extra miles of safety from bursting flak.

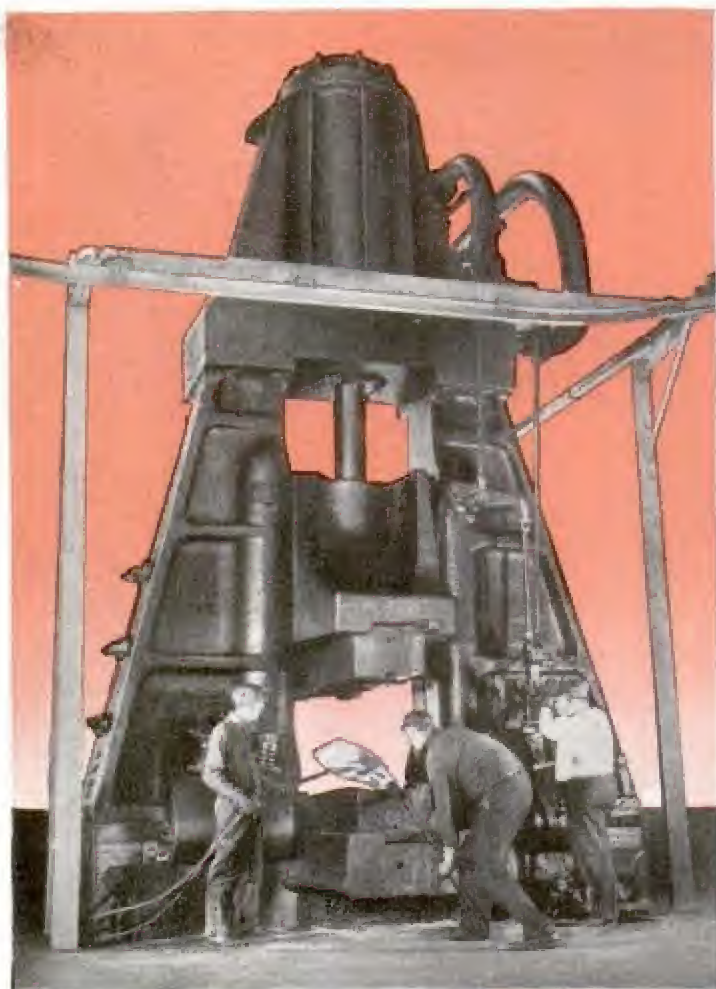
Only now can it be said that this nation is forging toward victory with a sufficient number of the machines which range from those used in pressing a hot sheet of aluminum into shape between dies, to huge drop forges crashing 35,000-pound hammers on giant masses of red steel with an 80,000,000-pound impact amid gusts of

smoke and spectacular showers of sparks.

Planning for war, the Axis nations frantically built forges years ago. Hoping for peace, the United States was woefully short, especially of the larger forges ranging up to 600 tons in weight, including a base of steel and concrete, and taking up to two years to construct.

First it was necessary to build enough of these hammers of war, often costing above \$200,000 each, to meet production needs for thousands of separate parts and products including all types of guns, projectiles, bayonets, knives, engine, truck and tank parts, submarine equipment, armor plate,





Chevrolet uses 35,000-pound hammers (above) to produce variable-pitch propellers. Below, Aluminum Co. of America's drop forge knocks out aluminum parts

superchargers, turbines, etc., requiring a wide range of size and power, plus a varied assortment of dies for shaping.

Next it was necessary to provide for the replacement of forges themselves, particularly those of high impact, since those triangular, guillotine-shaped mechanisms are so delicately adjusted that they begin to commit suicide the day they are put to work, literally tearing themselves apart as they pit steel against steel, battering huge chunks of glowing metal into useful shape. The life of the dies is even more limited.

Often in the early months of the war, it was our castings against the foes' superior forgings. Now it is forging versus forging, with quantity and quality on our side, including a margin of safety in replacements.

Hidden behind more thrilling battle headlines has been the story of the frantic struggle to catch up with the enemies' advantage in the possession of forges which change the whole character of an ordinary piece of metal.

Exactly what the impact of the forging hammer does to a section of hot metal has not been explained to the satisfaction of all theorists on the subject, although it is one of the oldest of mechanical arts, its development dating back to the day that the first horse was shod, the first knife, sword or plowshare was fashioned or the first coat of armor was tailored with a hammer. We know what to do to bring the results about, but not precisely how it is effected.

However, it is plain that when part of a billet of hot iron is pounded down, say, from the size of your wrist to the size of your forefinger while it is being put into useful form, the crystalline structure of the metal undergoes a fundamental change.

If you have ever absent-mindedly rolled a piece of soft







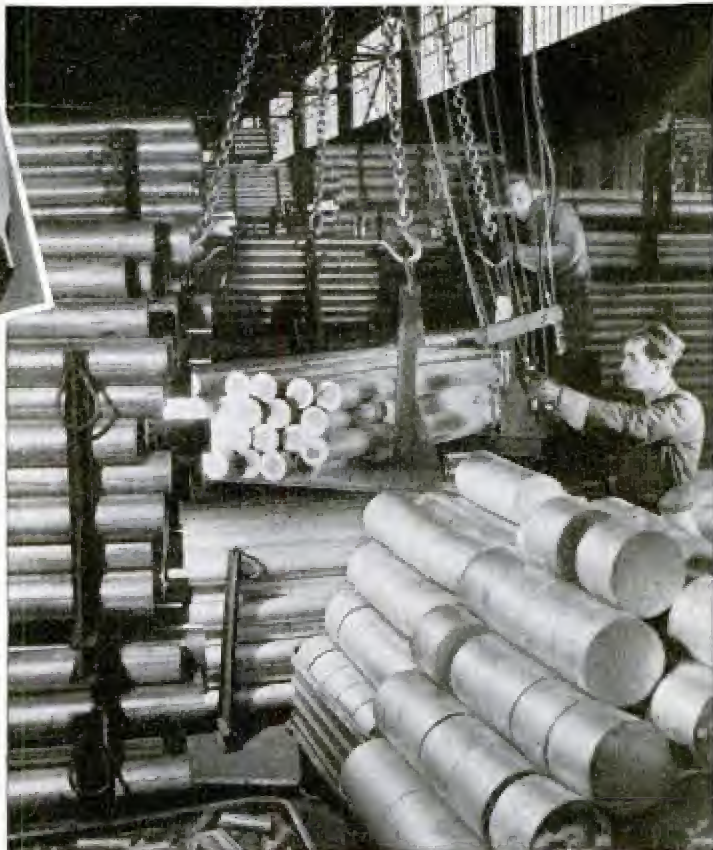
Above, typical forging dies and aluminum spray gun handle they form

bread between your thumb and forefinger while chatting at a dinner table—and who hasn't—you know it often takes on the characteristics of a tough, doughy rod, far harder to pull apart than the original bread. What you have done in rolling the bread is to realign the crystalline structure from a loose arrangement spread by the actions of yeast into a compact, longitudinal grain. By changing the direction and flow of the grain and tightening the structure you have added tensile strength and toughness. The rolled bread will hang together and bend, rather than crumble or crack.

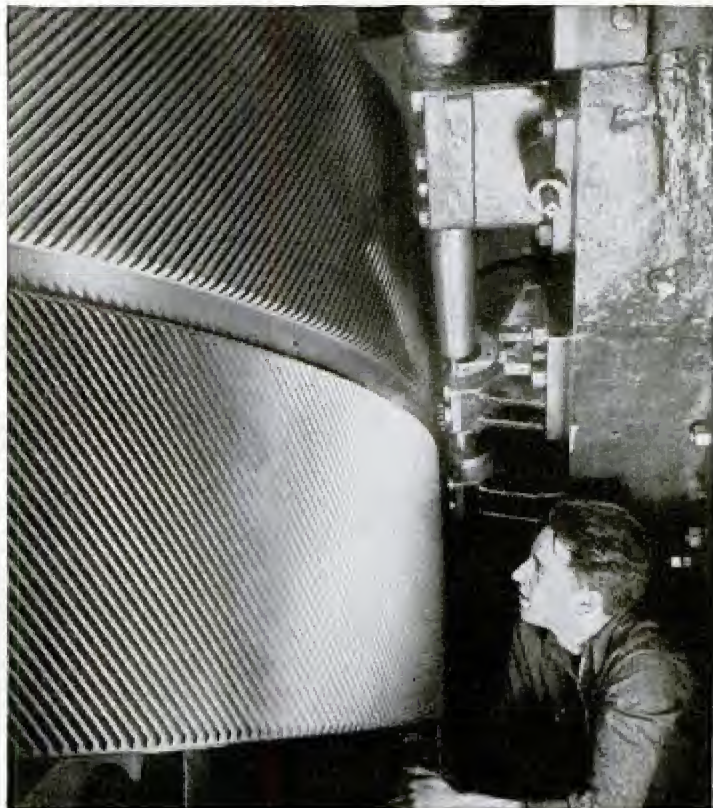
Thus, forging a piece of steel, iron, alloy, magnesium or aluminum—the most commonly forged materials in war processes—not only reduces its size, but gives it added strength which makes forged parts essential where metal must undergo great stress, shock, strain and fatigue, particularly in a moving part of a high-powered machine.

Building forges was only part of the problem Uncle Sam faced at the start of the war. Men had to be trained to build them, taught a craft which was known to very few. Huge plants had to be built to produce them. And after these bottlenecks were broken, men had to learn how to operate forges.

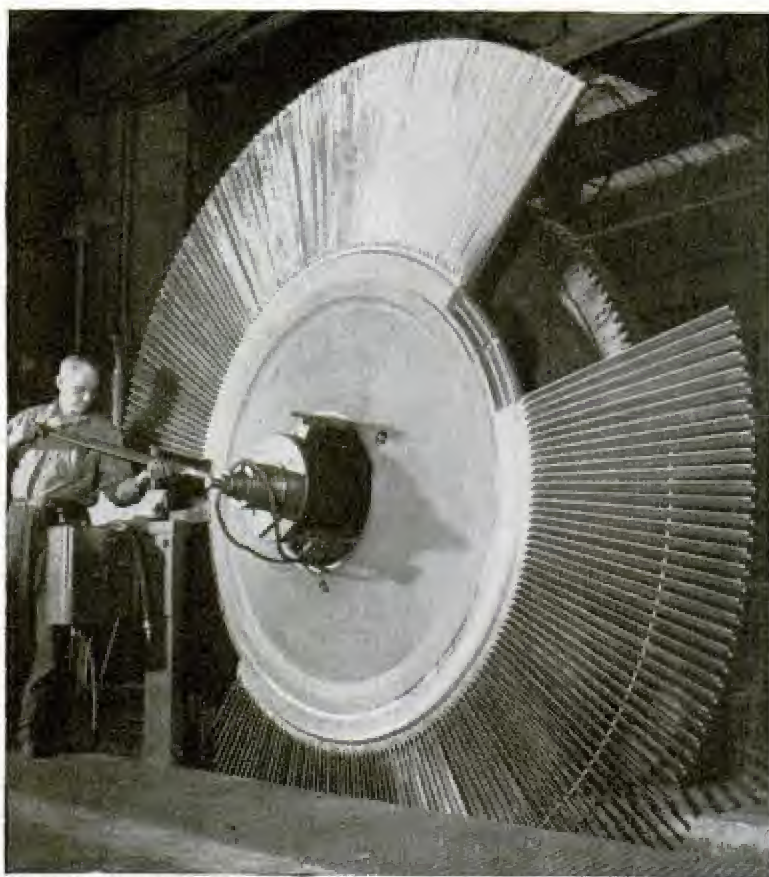
The operation of every type of forge requires a distinct form of craftsmanship. It is



Above, a stock pile of aluminum alloy forging stock in an Aluminum Company of America plant. Below, inspecting marine speed reduction gears in Westinghouse gear-cutting works. It takes expert forging and machining to produce gears with 1/10,000-inch tolerance







General Electric Co. photo  
Buckets or blades are pressed into position as turbine wheel is rotated

said that an excellent forge operator can bring down a 10,000-pound hammer with such delicate precision as to touch a fly without squashing it.

The man who operates the hammer is only one expert in a crew of experts. There are men who turn the metal and place it just right for the blow, others who judge the heat of the metal which will turn into a useless batch of scrap if too hot or too cool. Like the crew of a bomber, they must be able to spell one another on certain types of forges where the work is so strenuous that a rest is imperative every hour or so.

What these men have to know depends on the type of forge being operated, the kind of metal being worked and the nature of the product being turned out.

Behind these experts is a long line of other specialists in the production of forgings which will stand the inspection of our army and navy. They start the ball rolling by turning out the right quality of steel.

Surface of armor plate is "scarfed" after first forging to remove scale from plates before furnace heating for further forgings

A modern forging plant producing aircraft parts will not accept a shipment of steel which is not tagged with heat number to aid analysis, affidavits as to its qualities and treatment and other information which indicate how it can be handled successfully in a forge.

Next comes a step-down test in which pieces of the steel are turned to different diameters and deep-etched to determine if the alloy distribution is correct and uniform.

Before this steel is delivered to a drop hammer, a piece from each section of the particular heat is spark tested. A specialist with a trained eye applies each sample in turn to an abrasive wheel. Partly because of the carbon content and the alloys, the man who is making the spark test can tell by the volume and the color of the sparks whether all samples from a delivered lot are products of the

same heat of steel and will therefore stand the same stresses of forging.

With all this information and assurance of its quality, the forging crew has a pretty accurate idea of the temperature needed to work the metal under the hammer, much as a blacksmith, judging by the color of





the metal, knows when to start pounding on a horseshoe or a farm machine part.

A skilled metallurgist is usually on hand with instruments to check temperature of the first forgings in a given lot. These first forgings are cut into sections, etched and microscopically examined to determine the grain flow and other qualities.

Other sample forgings are cleaned and checked for accuracy in dimensions. Then the rough forging is usually machined down to the shape of the final product for final inspection.

Only in the last few months has heightened Yankee skill enabled the production of gears for trucks, tanks and military vehicles without customary machining. The new process enables a special forge to smack out gears with accurate teeth about as fast as a housewife can shell peas from pods. Almost all the machining operations are eliminated and already more than 1,000,000 pounds of high grade steel which would have been machined away in ordinary gear cutting has been saved for war effort.

Uncle Sam, it is safe to say at last, has not only caught up with the Axis in this field but is forging ahead day by day.

## Textile Fiber From Soybean Is Warm as Wool

Commercial production of a new fiber from soybeans, which holds considerable promise for use in textiles and fabrics, has just begun. So new that it has not yet been named, the soybean fiber has the warmth of wool, is resilient and can be blended with cotton or wool, or spun or woven into fabrics. Large scale production must await the installation of machinery now difficult to secure, hence the general introduction of the product may await the war's end. Experimentally, soybean fibers have been used in blankets, felt hats, underwear, hosiery, suits and upholstery.

Strips of wood veneer are bonded spirally with synthetic resin glue to form tubes used for radio masts, liferaft oars, and for conduit tubes in airplanes and boats.

## Bedsprings "Massage" Sleeper By Motor-Driven Gyration



"Setting up" exercises are taken lying down on this mattress

Equipped with an electric motor, a bedspring is said to relieve fatigue more rapidly through its relaxing qualities, induced by a gentle gyrating motion. The unit is said to produce a gyroscopic motion, "traveling" in small circles, that is transmitted to the body through the mattress. When used 20 to 30 minutes upon retiring and awakening, the gyrating springs also produce a passive form of exercise.

## Television Camera Scans City From Air

Using a lightweight television camera perfected by the Radio Corporation of America, a National Broadcasting Company crew "shot" a television broadcast of New York City from an airplane. The camera was part of a lightweight transmitter installed in a United Air Lines flying laboratory.





Map at Coastal Command 21st.

410 N. Michigan Ave. Chicago, Ill. 7695



## Giant War Map Is Used to Plot Allied Convoys

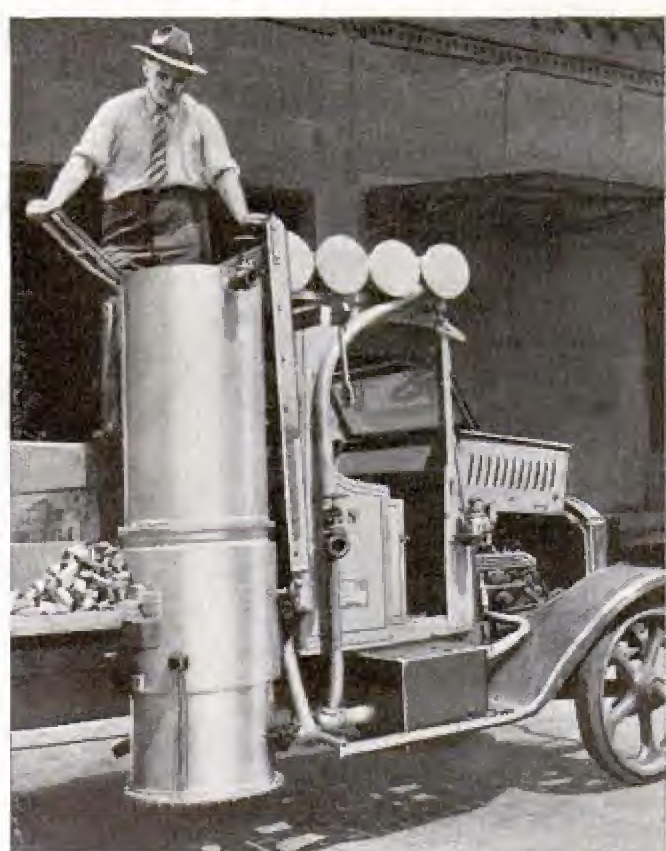
In the operations room of the British Coastal Command headquarters is erected one of the largest maps ever made on a conical projection. It depicts Europe and the North Atlantic, from above the Arctic Circle to the North African coast. It measures 20 by 30 feet. All movements of convoys and their escorts are plotted on this map, with the use of symbols. U-boats or other enemy vessels sighted by aircraft are also shown, as are the positions of Allied submarines and convoys.

One of the largest maps ever made on conical projection is used by British Coastal Command to plot convoy movements

Norman Case  
Phoenician, Brewery Club  
7661

## Wood-Burning Truck Has Generator on Side

Instead of gasoline vapor, gas from burning wood is used to operate a New York delivery truck equipped with a special generator. Gas from small pieces of wood burned in the generator, which is mounted on the side of the truck, goes through cleaning and cooling tanks on top of the cab. After being properly mixed with air it passes into the cylinders.



Cleaning and cooling tanks are mounted on top of truck cabin

## "Talkie" Films of Flights Reveal Students' Ability

What goes on in the cockpit during a test flight is revealed by a combination photo-recording device recently made public by the Civil Aeronautics Administration. During the flight the instructor's spoken observations are recorded on magnetized wire, while a continuous film is made of dial action on the instrument panel. The camera setup not only "shoots" the dials, but shows the movements of ailerons, rudders, and elevators.

88 Nat'l. Aeronautics Council's  
Committee on Selection  
and Training of Pilots





# The CRAFTSMAN

## Graceful LYRE MIRROR *on wall or vanity*



**By Benjamin Nielsen**

**D**ESIGNED to hang on a wall, this lyre mirror will harmonize with almost any furnishings, and if reduced to half the size given in Fig. 1, it will provide a novel vanity mirror for a dresser or table. The lyre motif is carried out in the hinged easel brackets or wings, which form an attractive support in the opened position, and fold flush with the sides of the mirror in the closed position.

The main part of the frame is of 1-in. walnut and is made in two parts band-

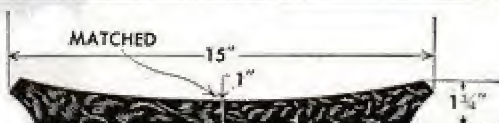


sawed to the shapes indicated in Fig. 1. Routing of the rabbet for the mirror can be done on a shaper or drill press, or it can be done by hand if no power tools are available. In either case, a little hand work will be

necessary to complete the rabbet at the bottom. Smoothing the edges on a drum sander as in Fig. 2, saves time and assures accuracy of design lines. By using a smaller size stick or drum for the tight places, practically all of the edges may be sanded in the lathe, leaving very little work to be done by hand. After the parts have been sanded, the frame is assembled, using a tongue-and-groove joint at the bottom and mortising in a piece across the top. This piece carries three knobbed pins as indicated in Fig. 4. The pins are glued in holes in the crosspiece and can be made of brass curtain rod or they can be made of wood and bronzed to simulate brass.

A hunt through the scrap pile may yield



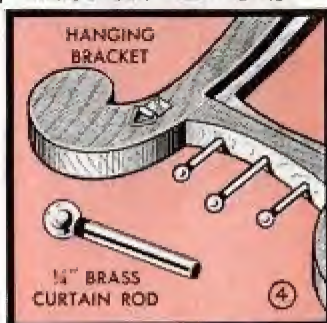


③ OVERLAY PATTERNS OF BURL OR CROTCH VENEER



$\frac{1}{16}$ " THICK, 5" DIA.

$\frac{9}{16}$ " R.



some interestingly grained pieces that can be shaped and worked down to a thickness of  $\frac{1}{16}$  in. for the overlay pieces, Fig. 3, which are glued in place. Surfaces on which glue is used are roughened before the glue is applied. Small brads, driven into the frame to project slightly where the overlays are to be applied, and then pointed, will aid in holding the overlays securely and prevent slipping when the gluing clamps are applied.

Brackets are cut from  $\frac{1}{2}$ -in. walnut to the same outside shape as the mirror frame, the only difference being at the hinged edges. After rounding the edges of the brackets, the frame is finished

with three coats of shellac rubbed down between coats with 4/0 steel wool. A plate glass mirror should be used. The mirror backing is cut from plywood, and is then used as a pattern or guide in cutting the mirror glass. Mirror and backing are inserted and secured in place with small brads. The brackets are now hinged to the back of the mirror frame as indicated in Fig. 5, and if desired, a hole is bored in the top crosspiece for hanging the mirror.

## New Oak Given Pickled Finish by Applying White Filler in Pores

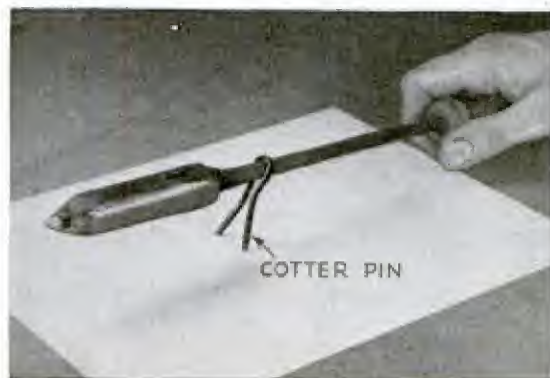
The open grain of oak offers more opportunity for novelty finishes than almost any other wood. These finishes are obtained by the use of a filler that can be rubbed off the surface of the wood but is retained in the pores. One popular oak finish is pickled oak, in which the wood remains its natural color, and the pores are white. To produce this finish, first brush the wood lightly, using a fine wire brush, such as a suede-shoe brush, to clean and smooth the surface and

remove dust that may be imbedded in the pores. Brush with the grain of the wood. Then apply a thin coat of shellac or other suitable sealer. When this has dried thoroughly, sand the surface smooth with No. 2/0 or 3/0 sandpaper, being careful not to cut through the sealer. A white sealer is next applied and any excess rubbed off the surface. After this has dried, it is ready for another coat of shellac. Then the varnish or other finish is put on.



must be at least 3 in. deep if the window is covered by a Venetian blind as this much space is necessary to operate the blind. As used originally in the U. S. Gypsum model research home, the valance was painted to match the walls, but it could also be painted to harmonize with the woodwork.

The problem of providing a support for a hot soldering iron is solved by using a large cotter pin as shown. The pin is spread at the top and shaped to fit loosely around the shank of the iron so that it will stand vertically and thus always be in position to support the iron when the latter is laid down. The legs of the pin are bent about half way up their length and spread to keep the support from tipping. If necessary, a wire ring can be clamped or soldered around the shank to keep the cotter pin from working up too close to the handle of the soldering iron.



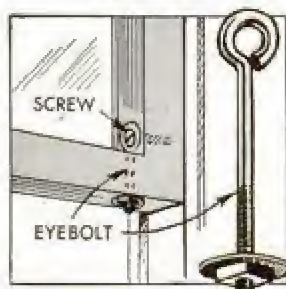


## Buggy Strapped to Wood Runners Quickly Changed Into Sled



Baby's buggy can be pushed over snow and ice as easily as it pushes across the living room floor if these simple wooden runners are made for it. They are cut out and fastened to crosspieces as shown in the illustration. Only a few seconds are required to slip them in place and strap them securely to the axles, which fit into slots cut in the upper edge of the runners, as shown. The runners will slide more easily if they are edged with sheet metal strips or heavy galvanized wire. Since the runners can be put on and taken off so readily, there is no need to remove the wheels.

## Sagged Window Sash Repaired With Screw and Eye Bolt



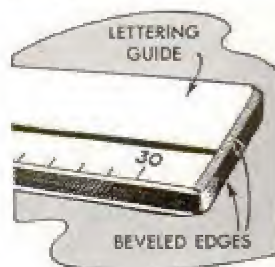
If the lower crosspiece of an upper window sash has a tendency to pull away at the mortise joints, here is an easy way to repair it. Just drill through the cross-

piece and put in a couple of small eye bolts as indicated. Then put the sash in two bar clamps, pull up the joints tightly and drive screws through the eyes of the bolts into the side of the sash.

## Edges of Lettering Guide Beveled For Easy Sliding on Work

By slightly beveling the edges of my lettering guides at the ends, they can be moved over the work without the edges catching on tape used to hold down the work. This does not interfere with the regular use of the guides, and can be done in a few minutes with a piece of fine abrasive paper.

—Robert L. Burleigh, Arlington, Va.



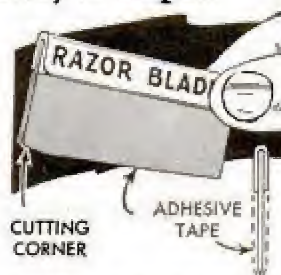
## Electric Heater From Headlight

An efficient and beautiful chrome-plated electric heater can be made at very little cost by using an old auto headlight. Just install a porcelain lamp socket inside the headlight shell to take a heating element, which can be purchased from electrical supply stores. The headlight reflector can be cut to fit behind the socket. A suitable handle can be had from an old electric flatiron, and a base can be found around most homes. In many cases, a scrolled iron base from an old floor or table lamp can be used. The headlight lens is replaced with screen wire, which is held in place by the lens rim.



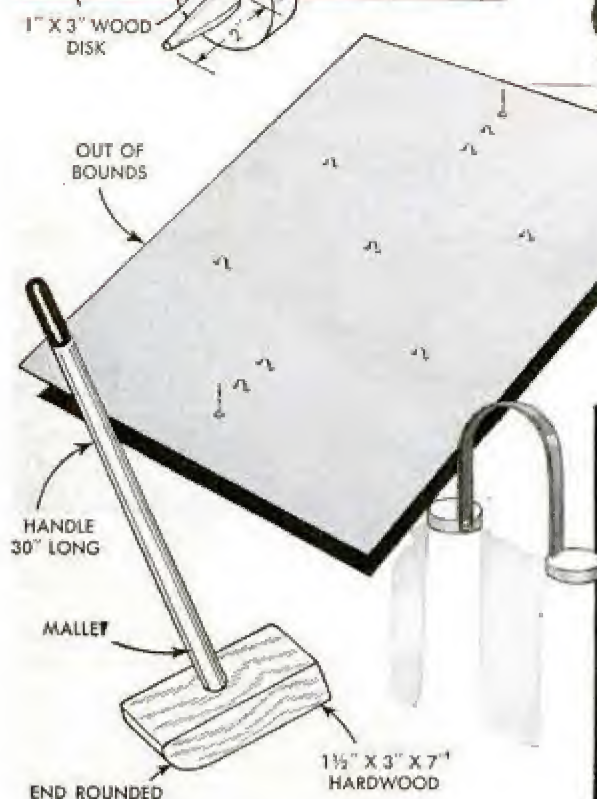
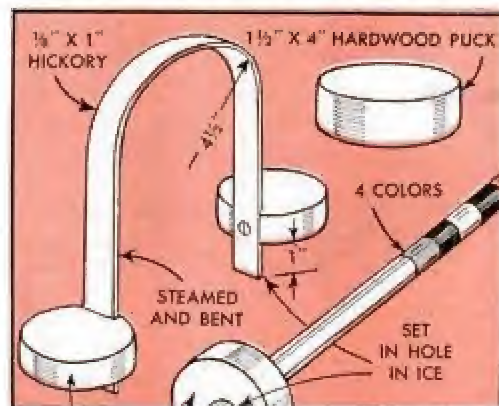
## Razor Blade Used for Cutting Handled Safely If Taped

To protect the fingers when using a razor blade for cutting papers and clippings from magazines, opening envelopes and packages and other purposes, cover the blade with adhesive tape as shown. The cutting corner will be pressed through the tape the first time it is used, but the rest of the blade will remain covered.





# Pucks Serve as Balls in Playing Ice Croquet



Specially made for use on ice, this novel croquet set permits you to enjoy this popular game the year 'round. Other than being played on skates and with a puck instead of a ball, the game is played and scored in the same way as on the lawn. The farther the wickets can be located apart, the better, as this will give you a chance to skate to retrieve the puck and also will make the game more difficult. The wickets and stakes are frozen solidly in the ice by setting the ends in holes filled with water. Lengths of broomstick will do for the mallet handles and stakes, and each puck should be identified by painting it a different color.

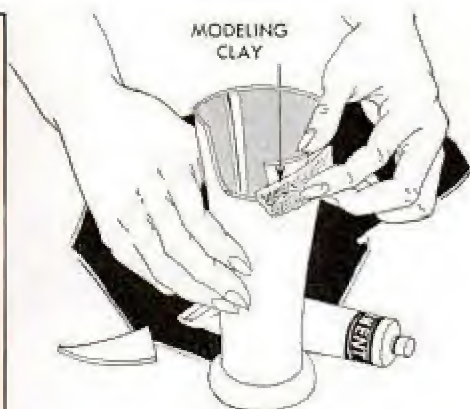
## How to Get Best Results When Using Pyroxylin Cements

Successful use of pyroxylin cements depends considerably on a thorough knowledge of their characteristics, and the proper methods to be employed. Unlike animal or fish glues, these cements never should be clamped tightly—either clamp very lightly until completely dry or just push the parts together with a single motion. Any movement of the pieces after they come together will weaken or ruin the joint. Wood or other porous material first should be given a thin coating of the cement and dried for half an hour, after which they are again coated liberally and brought together as above for 24 hours. These cements are very

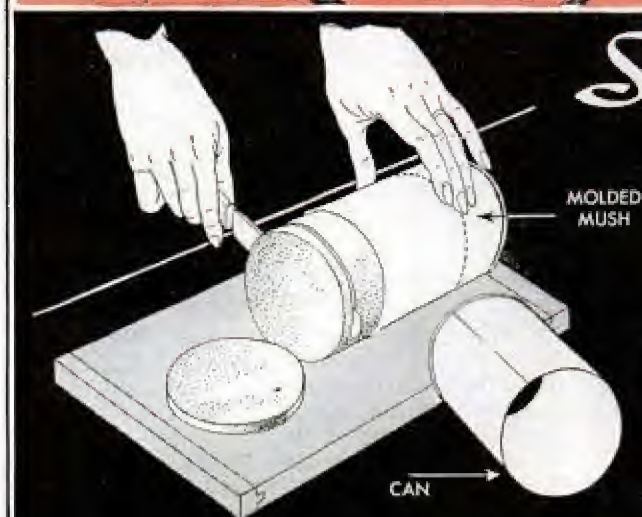
strong if used correctly. Use a surplus of cement, light pressure or none at all, and do not disturb the joint after assembling it. Most pyroxylin cements are of about the same composition, and about equally effective. Some are referred to as "liquid solder" or "cold solder," which are merely these same cements with a binder of aluminum bronzing powder. Generally the clear cement is preferable.

☞ To protect a check from being altered put a small strip of cellulose tape over the figures. This cannot be written over, and removing it will ruin the check.





Above: When mending glass or chinaware try modeling clay to hold the broken pieces in position while the cement is setting. Left: Using a fly swatter to place mending tissue in hard-to-reach places simplifies repairing tears in trouser legs and coat sleeves

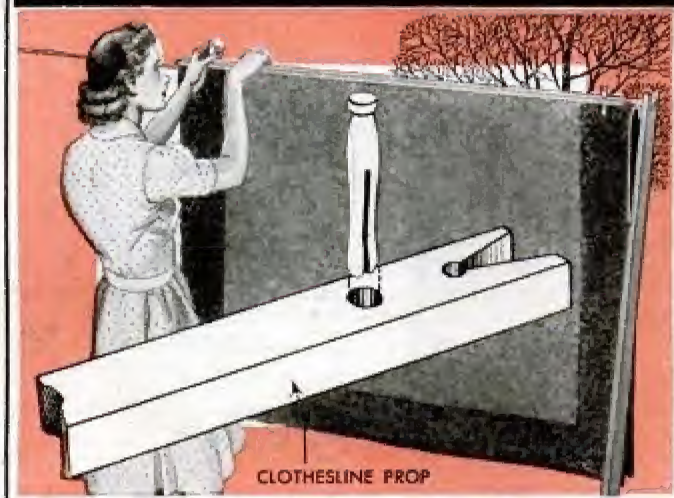


A tin can having both ends removed makes an excellent mold for cornmeal mush, as the mush can be pushed out and sliced for frying as needed. The can also keeps the mush from drying out when stored in a refrigerator

## Solving HOME



Torn lining in the toe of a shoe can be kept from wearing a hole in your hose by covering the tear with a patch of cloth adhesive tape, being sure the lining is smoothly in place before the tape is applied



Above: A neat replacement for a lost or broken tip on the end of an umbrella is a plastic bottle cap, which should be cemented in place with waterproof glue. Left: A rug will "stay put" while beating it on a line if a clothesline prop is pinned to the rug as shown with two clothespins through holes in the prop

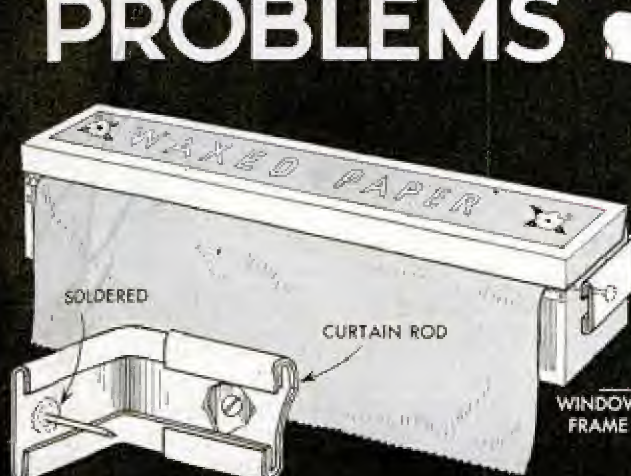




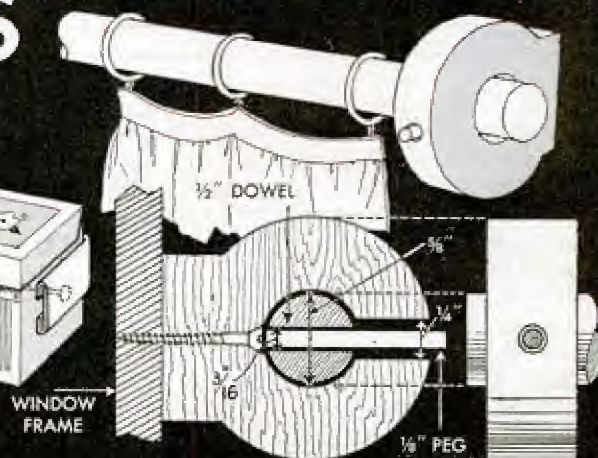
Above: Don't throw away the empty spool and container holding adhesive tape, use it as a dispenser for absorbent cotton. Right: Soot and smoke streaks on the wall around a hot-air register are avoided by sealing the crack with cellulose tape



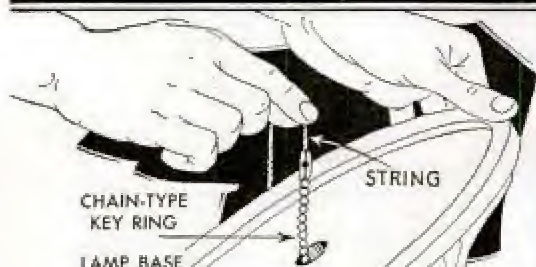
## PROBLEMS



By shortening an old flat-type curtain rod and soldering a nail in each end as shown, a neat adjustable bracket can be had to hold a box of waxed paper or cleansing tissue conveniently at hand on a wall



Where metal curtain rods are not available, inexpensive ones of wood can be made to fit windows up to 36 in. wide by using standard 1/2-in. dowels, the ends of which are pegged in small wooden brackets as shown



Above: "Fishing" a lampcord through a floor lamp is easy when a chain-type key ring is used to first work a string through the hole by which the wire is later pulled through. Right: By hinging a door between two shelves in a clothes closet and fitting it with a padlock, a neat lockbox is had in which to store valuable fishing equipment





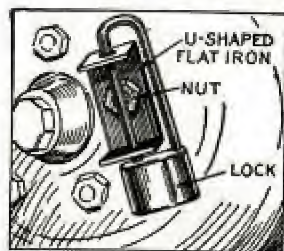
## Surgical Dressings Folded Quickly With Aid of Cardboard Guide



Folding of 4-in. square surgical dressings can be done uniformly if a guide like the one shown is used. It consists of a piece of white cardboard 9 by 16 in. in size marked off with waterproof ink as indicated. In use, the cardboard is placed on a flat surface, preferably on a black background, and the dressing to be folded is placed on top of the cardboard. The lines on the cardboard can be seen through the dressing so that no time is lost in measuring where to make the folds. Start with the lower edge of the dressing even with the bottom of the cardboard. Then fold the projecting portion of the dressing at the top down even with the top of the cardboard. Next, fold the bottom of the cloth up even with the line AB. Now, fold the sides toward the center to meet at the center line AA. Push loose threads at center in from the edge. Then fold the top of the dressing down to the bottom, and again fold it in the center. Guides for other bandage sizes may be similarly made.

—Mrs. Bernice Ashenfelter, Corning, Ia.

## Theft of Auto Tires Discouraged By Locking Wheel Nuts

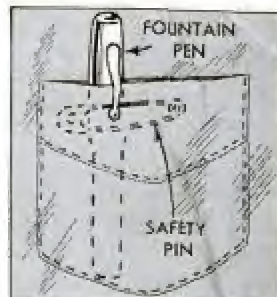


By locking one nut on each wheel of your car, you can make it very difficult to remove them and thus discourage theft. To do this, you will need a small

padlock and a strip of  $\frac{3}{16}$ -in. flat iron,  $1\frac{1}{4}$  in. wide and  $3\frac{3}{4}$  in. long for each wheel. Drill the iron pieces near the ends to take the padlock shackles and in their centers to slip over the wheel bolts or studs. Then bend the pieces to form wide U-shapes and slip over the wheel bolts as indicated. You will need small padlocks that have long shackles and, for convenience, it is a good idea to obtain locks that can be operated with the same key.—C. E. Packer, Chicago.

## Fountain-Pen Clip Holds Firmly Over Safety Pin in Pocket

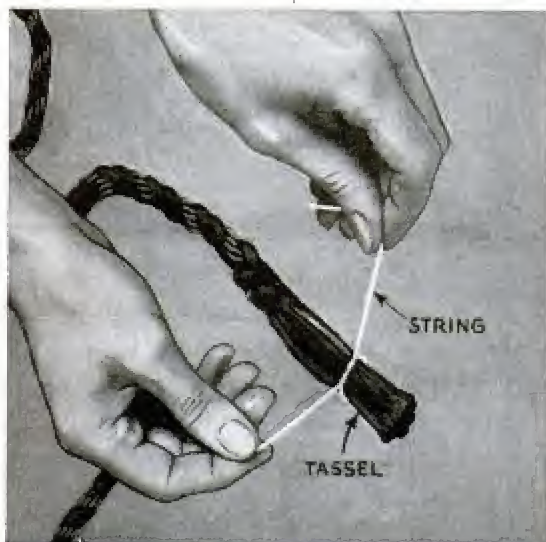
The possibility of a fountain pen slipping out of your pocket is lessened by using a safety pin inside the pocket near the top as shown. This is especially true when carrying the pen in a shirt, as the cloth is so thin that the pen clip is less likely to grip it firmly. The safety pin provides the necessary thickness to prevent this, and will not be noticeable if care is taken when putting the pin in place.



## Tassels Tied to Prevent Tangling When Laundering Them

If the tassels on some of your clothing or other laundry tangle and become misshaped when laundering them, just tie the tassels with string as shown. This will keep them in shape, and is much easier to do and takes less time than reshaping the tassels after they have become tangled.

—Benj. Nielsen, Aurora, Nebr.





# Decorative Covers Dress Up Cigarette Boxes



Topped by a metal ornament or a small jigsawed wooden figure, these covers are a novel way of dressing up boxes of cigarettes known as "flat fifties." The covers are especially desirable when the cigarettes are presented as gifts or when they are kept on a table or desk in the home or office. A wooden cover like the one pictured in the upper left-hand corner is assembled from thin stock as indicated in the detail below the photo. The metal cover is made from any available thin sheet stock, such as brass, copper, stainless steel, etc., and is cut and bent as indicated in the lower center detail. If desired, a beautiful engine finish can be applied to the metal cover by scoring it with an emery-cloth-tipped

dowel rotated in a drill press, using a fence to keep the scores in line. It is a good idea to first practice on a piece of scrap metal. A discarded dress ornament or a piece of dime-store jewelry soldered to the center of the cover adds a decorative touch.

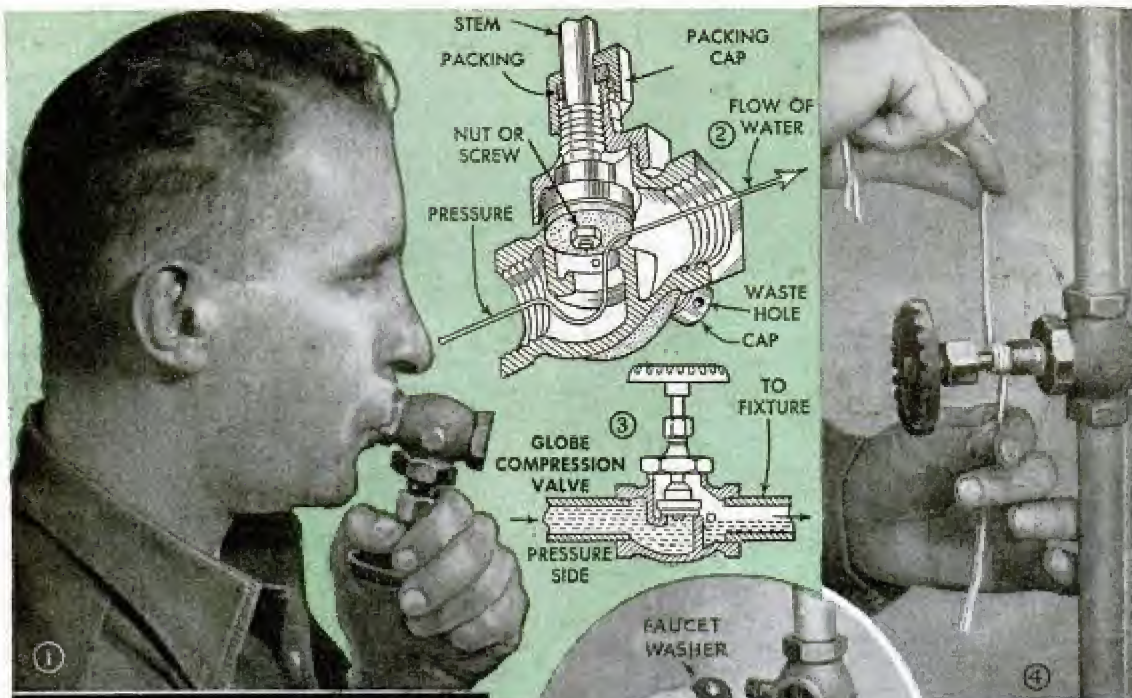
—Herman R. Wallin, Washington, D. C.

## Loose Joints Made Firmer by Wood Powder Used With Liquid Glue

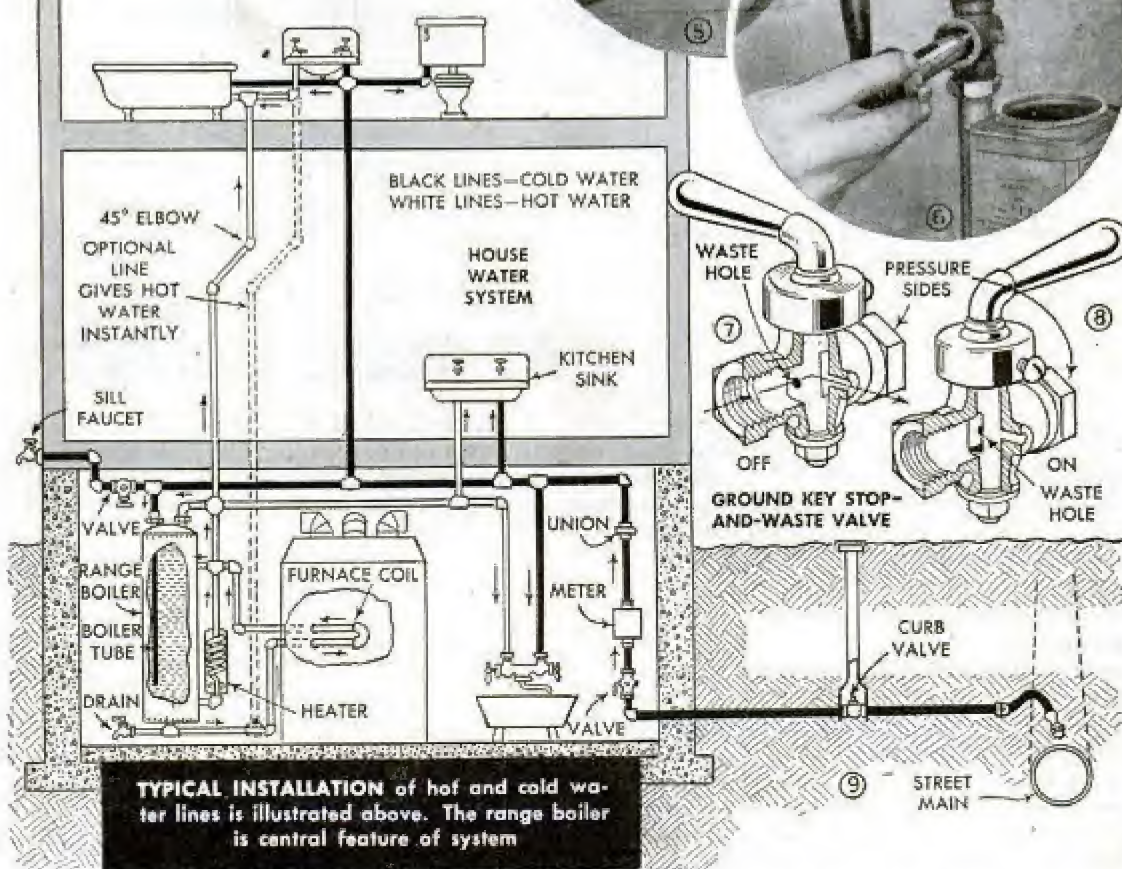
Joints are greatly strengthened and surface irregularities are filled in when this technique is followed in using prepared liquid glue on small joints such as chair legs, on inlays, gunstocks, etc. Coat both as liberally, press together and if possible rub the surfaces together for a mo-

ment. Then separate and allow to stand 3 to 4 min. Have at hand some finely powdered wood (prepared by rubbing a block over a sheet of coarse abrasive) and sprinkle this liberally over the glue on one piece. Add more glue to the other piece, press the two together and clamp firmly.





**VALVES** are usually globe compression type. Pressure end can be determined by blowing through valve as explained in text. Photos show simple repairs



**TYPICAL INSTALLATION** of hot and cold water lines is illustrated above. The range boiler is central feature of system



## IS THERE A Plumber? IN THE HOUSE?

**T**HERE are several small plumbing repair jobs that need only a little "know how" plus a few minutes work, and still another half dozen heavier repairs that are well within the capabilities of the average person.

**Valves:** No. 1 rule in plumbing is "Know your valves." If a leak should develop anywhere in the system, muss is held to a minimum if you know exactly where the main shut-off valve is located. Take the family downstairs some evening and show every member just where and how water, gas and electricity can be shut off in case anything goes wrong. The main shut-off valve usually is a stop-and-waste valve, which stops the water when turned off, and also has a small opening in one side or the bottom to drain off waste water standing in the pipes on the house side. The most common style of stop-and-waste valve is made in the familiar globe pattern, as shown in the cutaway view Figs. 2 and 3. This valve is of the compression type—being worked by turning the handle, which compresses a composition or rubber washer against the seat of the valve. The most common repair to globe valves is replacement of the washer, Fig. 5. Ordinary faucet washers are used, and the size is determined by the size of recess into which the washer fits. Leakage around the stem can be cured by unscrewing the packing nut and wrapping four or five turns of candle wicking moistened with soap or oil around the stem, as in Fig. 4. Ordinary string will do in an emergency.

The ground-key stop-and-waste valve, Figs. 7 and 8, is used in the same capacity as the globe valve, but works in an entirely different manner. This valve is a metal-to-metal contact, the tapered stem having a hole at its center which blocks or



**PIPE LEAKS** can be repaired permanently with rubber hose, as shown above. Other temporary methods are shown below together with table for determining length of pipe replacements

**TEMPORARY PIPE REPAIRS**

11. TRIPLE WRAPPING OF FRICTION TAPE

12. WIRE, SHEET METAL, RUBBER PAD, WOOD PLUG TAPPED FOR SCREW

13. UNION

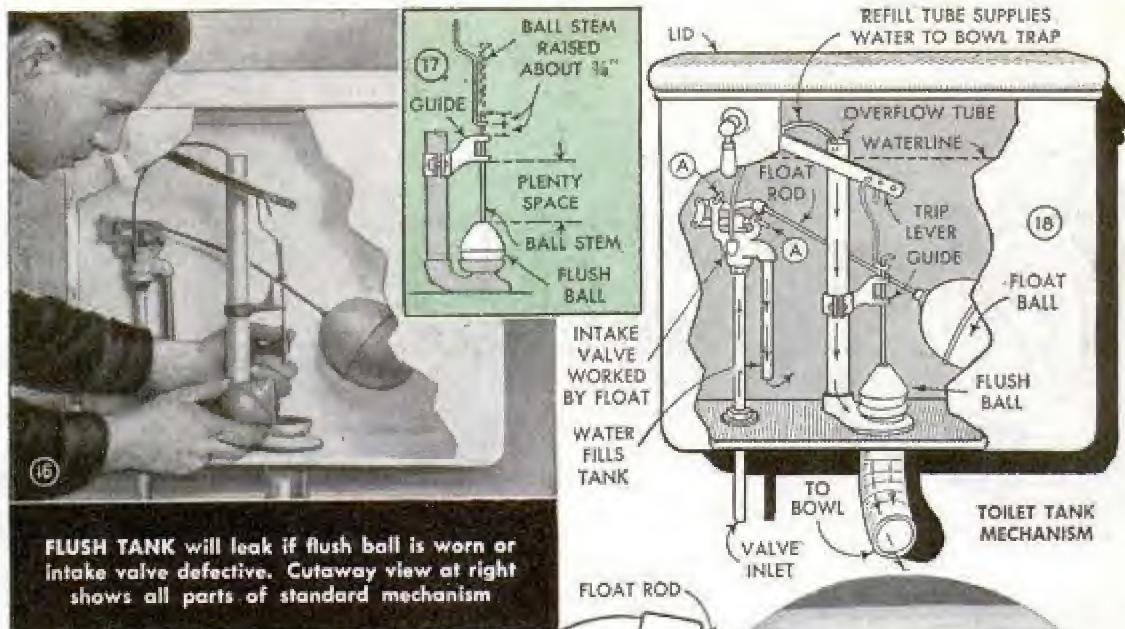
14. PIPE LENGTH NEEDED EQUALS A MINUS B PLUS 4 JOINTS

15. PIPE SIZES

Name Size	Outside Diameter	Inside Diameter	Distance Thread Enters		
			Single	2 Joints	4 Joints
3/8 in.	.675	.493	3/4 in. +	9/16 in.	1 1/4 in.
1/2 in.	.840	.622	3/4 in. -	1 1/16 in.	1 3/4 in.
3/4 in.	1.050	.824	3/4 in.	3/4 in.	1 1/2 in.
1 in.	1.315	1.049	1/2 in. -	15/16 in.	1 3/8 in.
1 1/4 in.	1.660	1.380	1/2 in.	1 in.	2 in.

Most Common Sizes

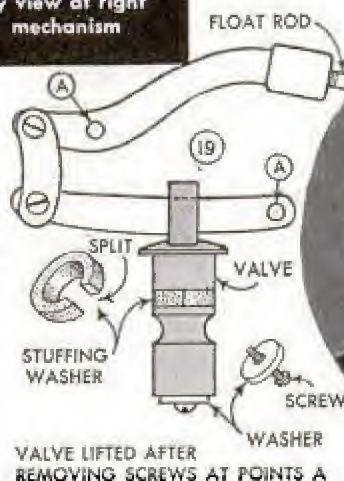




passes the water with a quarter turn. The valve will leak if the contacting metal surfaces become roughened. The obvious cure is to regrind the valve with valve-grinding compound or a paste made from fine abrasive powder and water, Fig. 6.

All stop-and-waste valves have a pressure side which must be fitted to the pressure side of the piping. If the valve is installed backward, it will leak water continually through the waste hole. Fig. 1 shows how a check can be made by blowing through the valve. If the valve is the globe type, open the cap that closes the waste hole. Now, with valve turned off and the waste hole open, you can blow through the house or fixture end, but you can't blow through the pressure end. On the ground-key valve, the waste hole is opened automatically when the valve is closed.

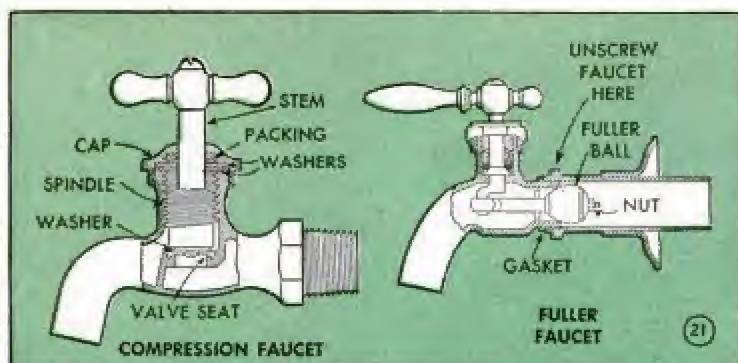
**Pipe leaks:** The best "fix-it" for a leaky pipe is to cut out the poor section and couple the pipe ends with rubber hose and hose clamps, as shown in Fig. 10. A repair of this kind will last for years. 1-in. automobile radiator hose is the right size for  $\frac{3}{4}$ -in. pipe;  $\frac{3}{4}$ -in. garden hose will fit  $\frac{1}{2}$ -in. pipe. Other emergency ways to stop a leak are shown in Figs. 11, 12 and 13. Doping with white lead, varnish or anything of similar nature under the patch will assure a good job. Of course, the best way is to install a new pipe. When you do this you will need a union connection as in Fig. 14, since you can't screw both ends of a



pipe in place at the same time. The last column of the table in Fig. 15 will help when calculating pipe lengths required.

**Toilet flush tank:** Likely about every 2 or 3 years the toilet flush-tank mechanism will need attention. Worst offender is the flush ball, Fig. 18, which becomes worn and permits water to escape continually into the bowl trap. Fix it by installing a new ball, observing the clearances required, as shown in Fig. 17. Fig. 16 shows the operation, but in actual practice you lift the ball stem and then turn the stem with one hand while you hold the ball in the other. Be sure that the guide is high enough. If it is too low, the ball will immediately drop back into the opening unless held up by holding the trip handle. If the new ball doesn't stop the flow of escaping water in the bowl trap, check the intake valve. First, pull up the float rod. If this stops the leak, all you have to do is bend the float rod as in Fig. 20, to put more pressure on the valve. If this does not stop the leak, the trouble is probably in the valve itself. Remove the valve core, float





**FAUCETS** are usually repaired by fitting new faucet washer. Sequence of operations in this simple repair are illustrated by the photographs on this page



rod and float ball by unscrewing the two thumbscrews marked A in Fig. 18. The mechanism you remove will look like the detail in Fig. 19. Replace the washer at bottom (use a faucet washer of the right size), also inspect and replace, if necessary, the leather stuffing washer at the center of the core. When repairing a flush-tank valve, the water supply must be shut off. If the job is merely a new flush ball you can shut the water off at the tank itself by holding up the float rod.

After the flush-tank mechanism has been put in good condition, oil the trip-lever mechanism occasionally. Check the float ball for leaks by shaking it gently with the tank empty. If desired, the end of the refill tube can be pinched together slightly to conserve water since it supplies more than enough water to fill the bowl trap; the end must not be below water level.

**Faucets:** These need attention more frequently than any other part of the plumbing system. They differ in external appearance, but the working mechanism is always the same. Chances are your faucets are compression type. If the water comes on full blast with half a turn of the handle, they are quick-compression type. If it takes four or five turns, they are ordinary or slow-compression



23 TURN COUNTER-CLOCKWISE AND PULL OUT SPINDLE



24 REMOVE SCREW HOLDING WASHER. TAKE OUT WASHER



25 FIT NEW WASHER OF PROPER SIZE. REASSEMBLE

22 UNSCREW PACKING CAP WITH MONKEY WRENCH

type. Both work the same way. The full-ball type of faucet has been off the market for a number of years, but is still found in actual use. Typical compression and full ball faucets are shown in Fig. 21. The compression type is repaired by replacing the washer at the end of the spindle, the whole operation being as shown in Figs. 22



26 IF VALVE SEAT IS ROUGH, SANDPAPER SMOOTH





**REMOVING OBSTRUCTIONS** is less trouble when proper tools such as force cup and coil-spring augers are used. Obstructions treated promptly seldom become serious

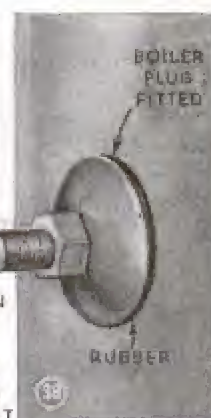
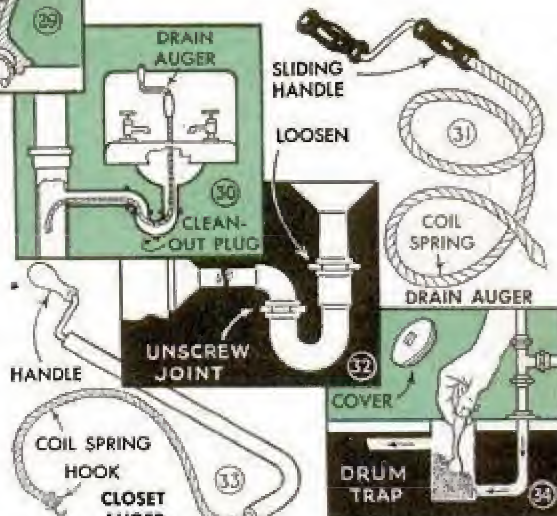
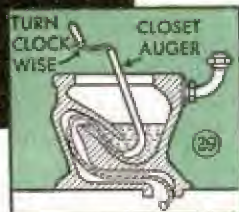
to 25 inclusive. Equally simple, the fuller faucet is repaired by unscrewing the portion shown in Fig. 21 and fitting a new rubber fuller ball.

Be sure the main valve is turned off before you fix faucets. Open the faucet to release standing water and back pressure, then go ahead with the repair. While you're at it, inspect the valve seat (compression faucets) since a new washer is of little use if the seat is rough or scratched. If mildly rough, smooth it with a disk of sandpaper on a stick as shown in Fig. 26; if very rough, invest fifty cents in a faucet reamer. Of course, the faucet can leak at other points independent of the washer.

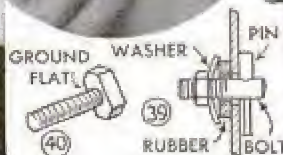
If the leak is at the top of the stem, remove the handle and packing cap and replace the packing. If you haven't a regular packing ring, you can use candle wicking or string moistened with oil or soap. If a faucet leaks at the threaded part of packing cap, unscrew the cap and wrap a piece of thread around the threaded portion.

After a faucet valve seat has been smoothed by reaming several times, it may require two washers instead of one to get the necessary contact. If the valve seat is hopelessly worn, you can buy composition insert seats and make the valve as good as new. For a few cents extra you can buy a faucet washer fitted with a ball bearing ring, which reduces abrasion wear to zero and gives good results even on roughened valve seats.

**Removing obstructions:** Every home owner is familiar with the force cup shown in Figs. 27 and 28. On lavatory and bath connections, you can get more positive results if the waste opening is plugged with a wet cloth as shown in Fig. 27. Obstructions in the toilet bowl usually are easily removed with an inexpensive closet

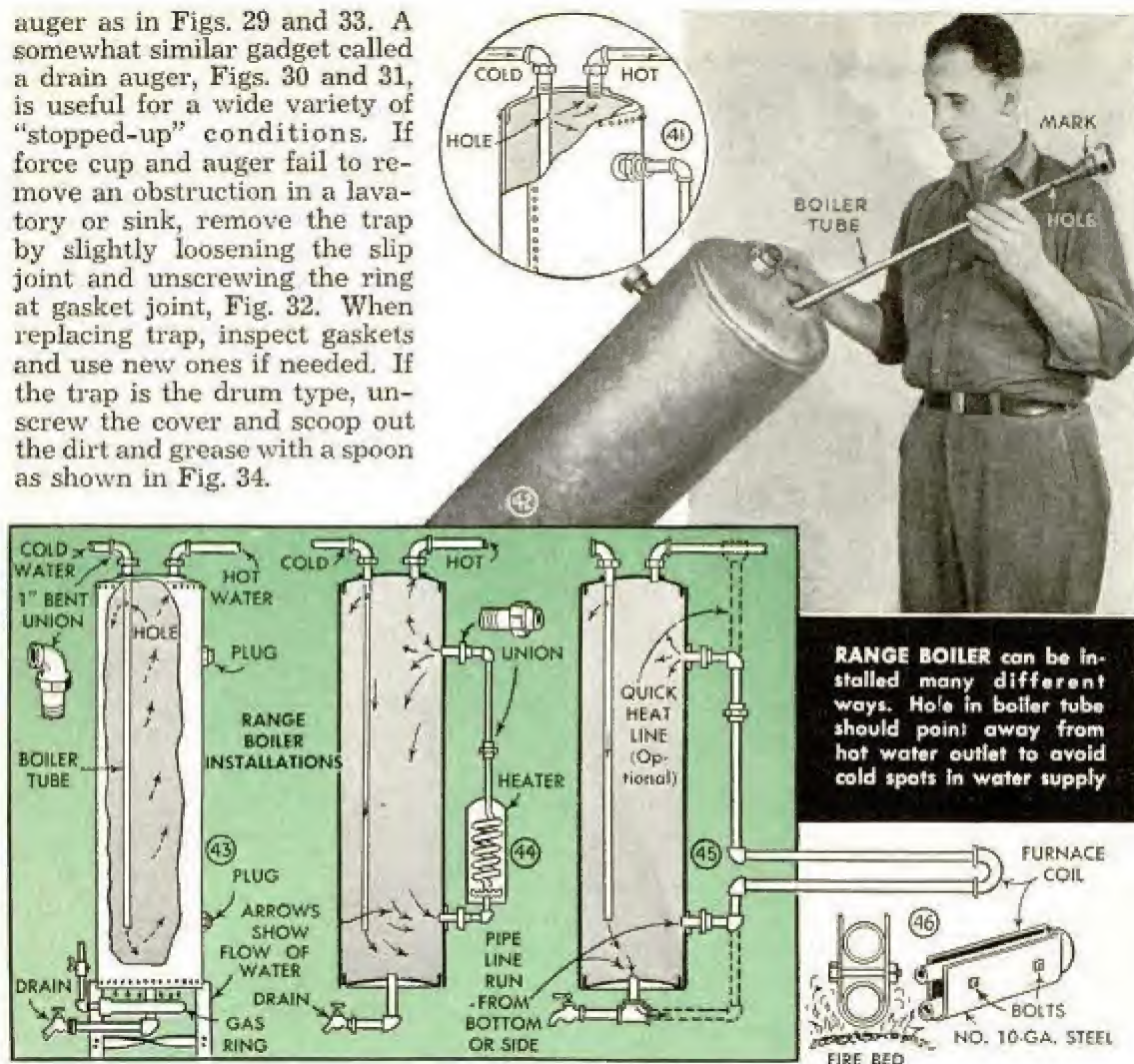


**TANK LEAKS** can be repaired by using boiler plug. If the tank is not completely rusted out, a repair of this kind will give very good service





auger as in Figs. 29 and 33. A somewhat similar gadget called a drain auger, Figs. 30 and 31, is useful for a wide variety of "stopped-up" conditions. If force cup and auger fail to remove an obstruction in a lavatory or sink, remove the trap by slightly loosening the slip joint and unscrewing the ring at gasket joint, Fig. 32. When replacing trap, inspect gaskets and use new ones if needed. If the trap is the drum type, unscrew the cover and scoop out the dirt and grease with a spoon as shown in Fig. 34.



**Tank leaks:** The average galvanized water tank has a life of about seven years. When it starts to leak, you might as well get a new one. Leaks can be stopped temporarily by driving in soft wooden plugs, as shown in Fig. 35. More permanent is the regular boiler plug sold for this purpose. To fit the plug, enlarge the hole, Fig. 36, so that the plug can be inserted as in Fig. 37, then fit the rubber washer and draw up tight to complete the job as in Figs. 38 and 39. A similar repair can be done by grinding the head of a bolt, Fig. 40, enlarging the opening to admit it and turning it cross-wise, using a rubber disk in the same manner as with the boiler plug.

**Installing new range boiler:** Any of the installations shown in Figs. 43 to 46 inclusive will give good results at minimum expense for new parts. Simplest of all is the gas ring below the tank, shown in Fig. 43, its only fault being that heat absorption is not efficient due to the small tank area exposed to the gas flame. The side-arm gas heater, Fig. 44, makes a good

set-up. A furnace coil is seldom used alone since it works only when the furnace is going. Fig. 9 shows how a furnace coil is combined with a side-arm gas heater or gas ring. The "quick heat" line, Fig. 45, can be installed in any set-up, and has the feature of supplying a small but very hot supply of water almost instantly. Best of all from a circulation standpoint is a secondary hot water line, as shown by the dotted lines in Fig. 9. This gives complete circulation so that the water is hot right up to the faucet, but has the disadvantage of continuous circulation of the water which causes the two pipes to act as a radiator.

The boiler tube must be inserted before the tank is set upright, Fig. 42, since it is too long to be fitted in the average height of a basement. The hole at top of tube prevents water from being siphoned out of the tank when the water is turned off. Its position should be marked so that it can be located facing away from the hot water outlet, otherwise cold water from the hole mixes with the hot water, Fig. 41.



## Bundle Rack on Baby's Carriage Will Hold Several Packages



Any mother who must take the baby in its carriage while shopping will appreciate this bundle rack, which provides a safe place to carry her packages. Made from thin wood strips, the rack fits under the carriage body where it is supported on the front axle by wires or straps around the axle and carriage frame. The rack is open at the front for easy insertion of packages, which are retained by a wire and hook as indicated.

—Leslie A. Nicholson, Jersey City, N. J.

## Gliding Surface for Pantograph By Using "Cellophane"

When enlarging a picture from a newspaper with a pantograph, often the tracing point of the tool will not glide easily over the rough surface of the paper, and some-



times causes distortions or errors in the copy. To overcome this, one artist tacks a sheet of Cellophane on the table and slips the news picture under it. The Cellophane not only provides a smooth tracing surface, but the pocket thus provided permits the insertion of one picture after another without the employment of tacks. Even pictures that have been folded or creased are smoothed to simplify the copying work.

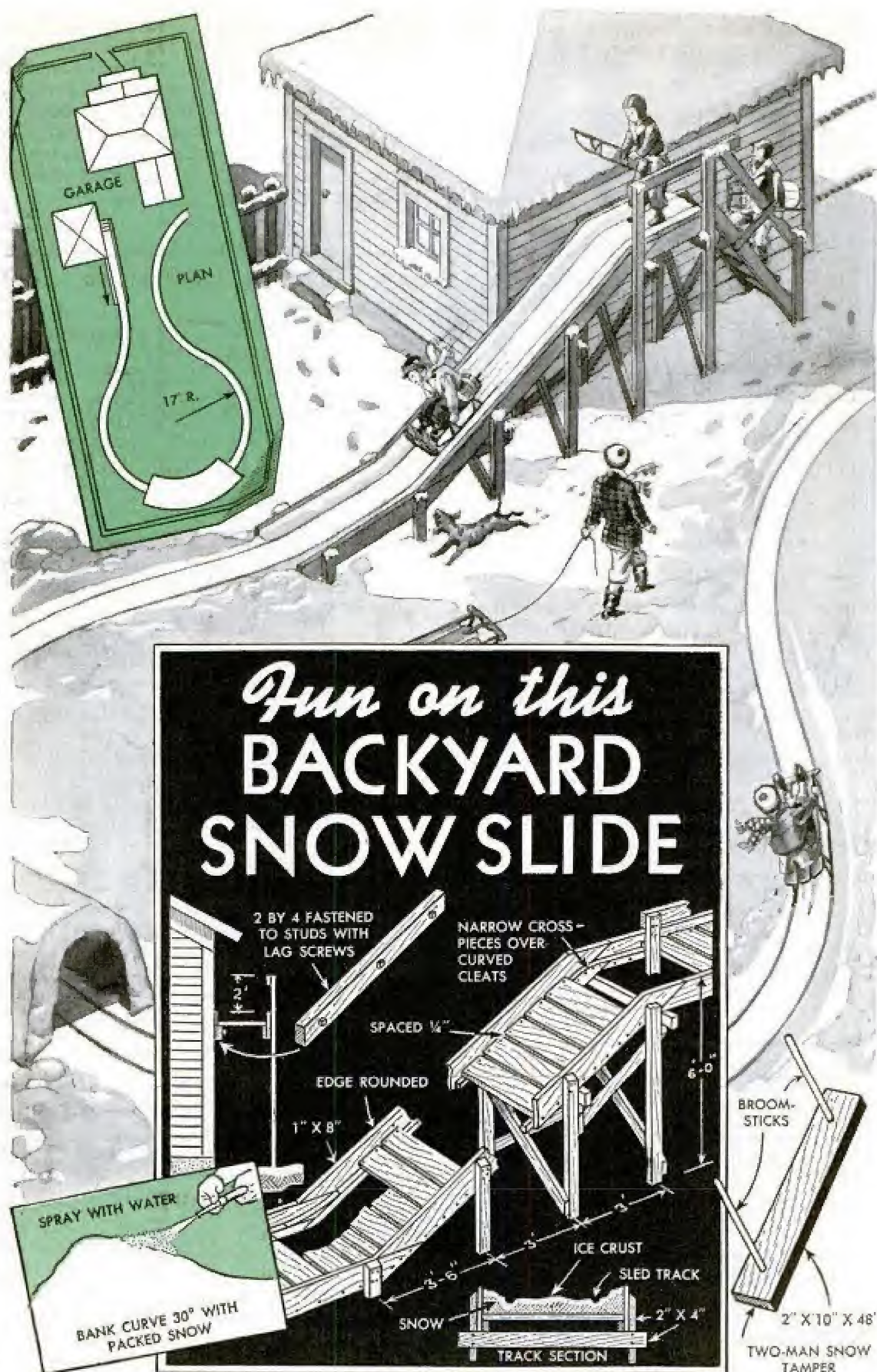
## Children's Inexpensive Slide

Any kind of strong scrap lumber will do for building this small snow slide. If two-by-fours of sufficient length are not available for the supports, short ones can be spliced, which also applies to other parts of the structure. Building the framework against a garage saves material and helps make a rigid slide. When attached to one side of a building, supports next to the building can be eliminated. If this is done, first install a two-by-four with lag screws driven into the wall studs, and build the starting platform on this, using supports on the outer side. The inclined part is a wooden trough with cleats to support the bottom boards, which are spaced  $\frac{1}{4}$  in. to anchor the snow. The trough is rounded at the top and bottom of the inclined section and leads off on a runway. The platform is reached by a ladder or steps. Pack the trough with moist snow, tamping it down thoroughly, and make tracks with a sled having fairly wide runners of standard spacing. When it is cold enough to freeze, apply water to the runway with a hose, using a fine spray. On narrow city lots the track can be continued as a wide curve banked at 30 degrees and kept at least 3 ft. from all fences or buildings. The bank is built up of moist snow and tamped down, after which tracks are made with a sled and then sprayed.

## Shaving Conceals Screw Head

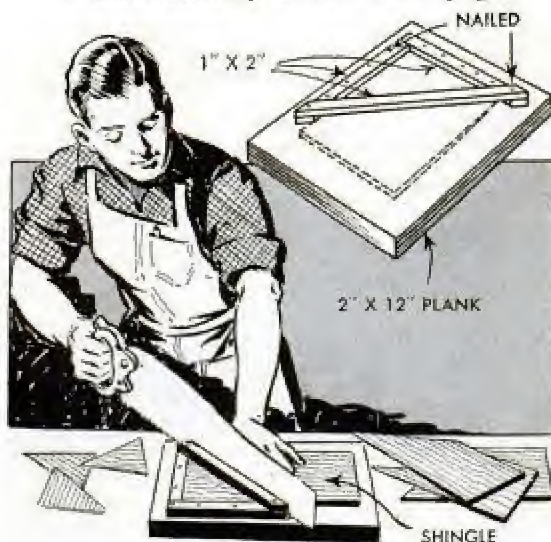
Concealing a screw head while doing furniture repairing or other work where the screw should not show is accomplished effectively by soaking or steaming the spot and curling up a shaving about  $\frac{1}{32}$  in. thick with a very sharp chisel, leaving one end attached. Drill and countersink the hole in the portion of the wood immediately below the shaving; coat the screw with glue and drive it in. Then lay the shaving back, gluing it in place. Cover with blotting paper and clamp until dry. When sanded, the cut will scarcely be noticeable.







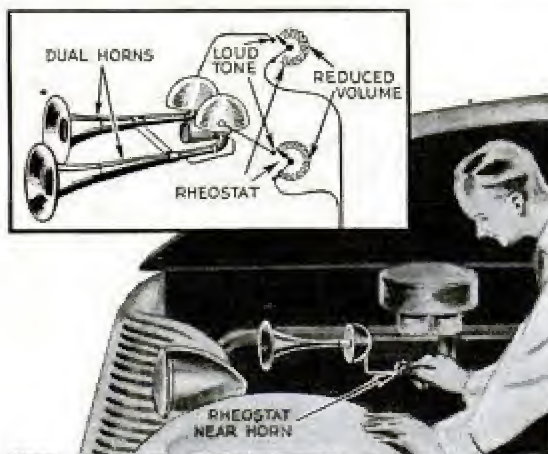
## Duplicate Angle-Sawed Shingles Made Easily With This Jig



Whenever wood shingles are fitted along a roof valley or other place where one side of each shingle must be cut at the same angle, this jig will save time in duplicating the cuts. After one shingle has been cut to the required angle, it is placed on a block or plank and wood strips are nailed along the top edge and one side. Then, a third strip is nailed on top of the strips flush with the ends to serve as a saw guide. Now the cut can be duplicated on each shingle simply by inserting it into the jig and sawing off the waste stock as indicated, thus making it unnecessary to mark guide lines on the shingle, or nail a shaped one to it to serve as a pattern.

## Tone of Auto Horn Changed By Use of Small Rheostat

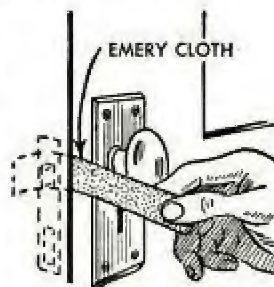
An ordinary rheostat switch of the type used on a car heater can be used to regulate the tone of an auto horn, or to serve as a quick means of shutting off the horn



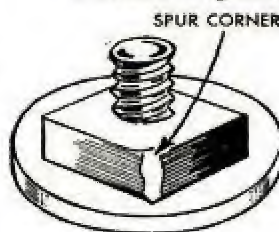
should a short-circuit develop in the wiring and cause the horn to blow continuously. The best location for the rheostat is right at the horn, two rheostats being used for dual horns. For city driving, reduced volume may be obtained by cutting in some of the resistance of the rheostat, while for maximum volume, the rheostat will be turned to the full "on" position.

## Emery Cloth Strip Marks Location Of Door Latch Plate

When hanging a new door, the latch plate can be located accurately by using a strip of emery cloth. This is folded over the edge of the door as indicated, so that it is directly over the end of the latch bolt. Then, when the door is closed, pressure of the latch spring will force the latch against the emery cloth and make an impression on the door casing.



## Spur Corner Locks Nut Firmly When Tightened on a Bolt

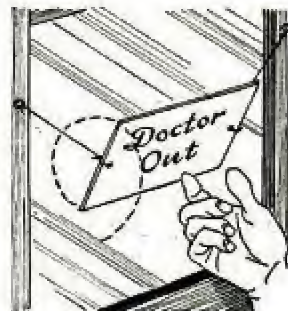


The next time you want to lock a nut on a bolt and there is no locknut at hand, just form a spur on one corner of the nut by flattening it slightly with a hammer.

When the nut is tightened down against a washer, the spur will cause the nut to tip slightly so that it grips the bolt threads quite firmly and will not loosen easily.

## "In-and-Out" Sign on String Is Easy to Reverse

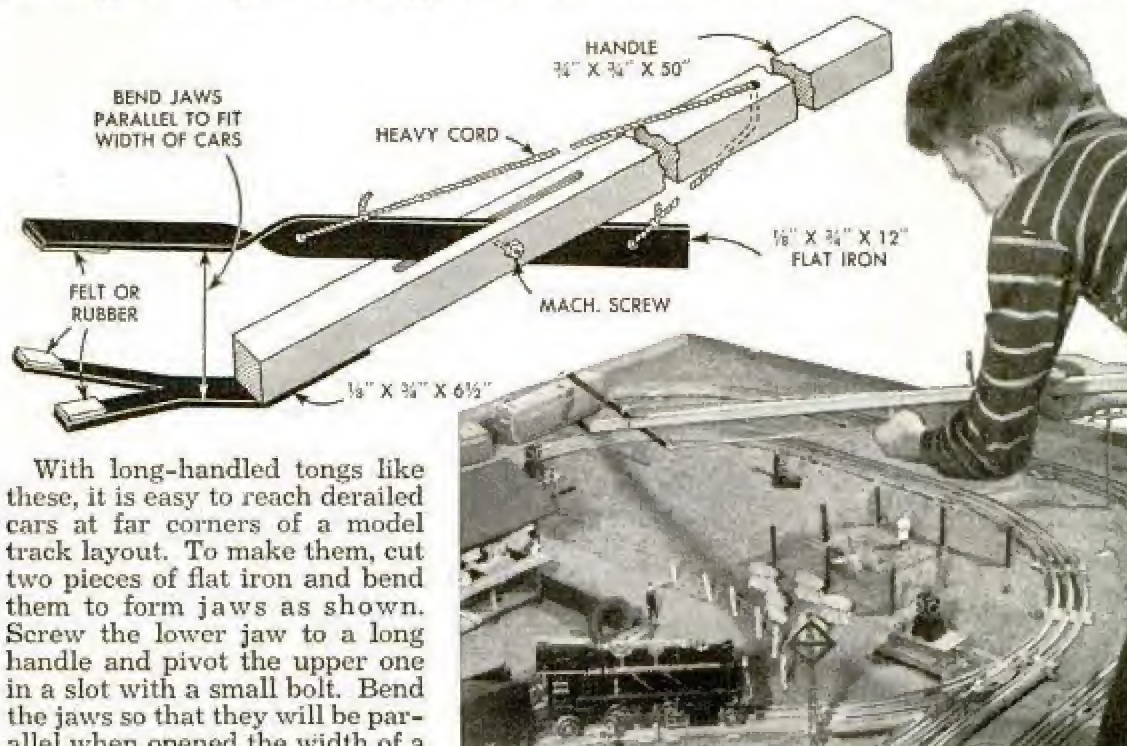
A door sign that may be changed instantly with a flip of the finger can be made by lettering a piece of cardboard, which then is suspended by a length of string at each end. By pushing up on the lower edge of the sign, it turns over so that the reverse side is brought into view.



—G. E. Hendrickson, Argyle, Wis.



# Long Tongs to Right Derailed Model-Train Cars



With long-handled tongs like these, it is easy to reach derailed cars at far corners of a model track layout. To make them, cut two pieces of flat iron and bend them to form jaws as shown. Screw the lower jaw to a long handle and pivot the upper one in a slot with a small bolt. Bend the jaws so that they will be parallel when opened the width of a car, and run a cord from a hole in the one end of the movable jaw up through a hole near the end of the handle and back to a hole in the opposite end of the jaw. To use the tongs, you simply pull

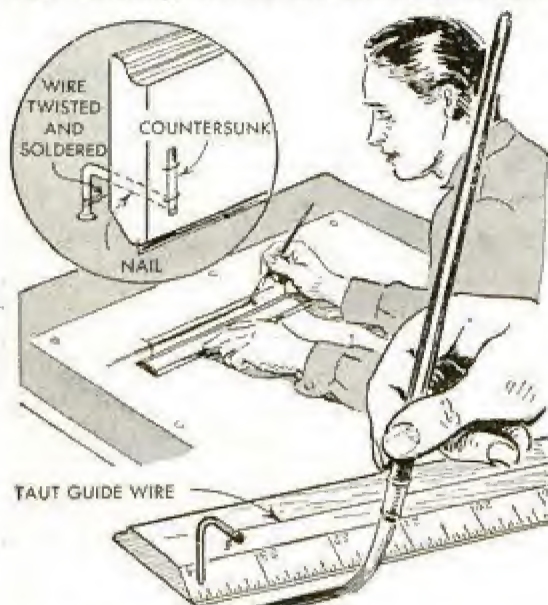
on the upper cord to open the jaw, slide it under the derailed car and then pull on the lower cord to grip the car.

—C. Elmer Black, Philadelphia, Pa.

## Guide Wire on Ruler to Make Straight Lines With Brush

An ordinary ruler may be used as a straightedge for drawing lines with a small brush if it is fitted with a taut wire as indicated to keep the brush away from the edge of the ruler. As indicated, wire nails

are inserted through holes near the ruler ends and are clinched into grooves on the underside of the ruler where they are secured with small staples. The head ends of the nails then are bent over at right angles toward the ruler edge and notched with a file. The wire is pulled taut, wound into the grooves and soldered to secure it.



## Tweezers Made From Toothpicks Handle Delicate Work

Modelmakers and others who work with tiny wood pieces can improvise a pair of tweezers for this work by gluing three toothpicks together as indicated. The tweezers may be used as gluing clamps to hold pieces together while the glue dries, or to grip and hold small screws, bolts or nuts while inserting them.





# It's Fun Making BUILT-UP TURNINGS

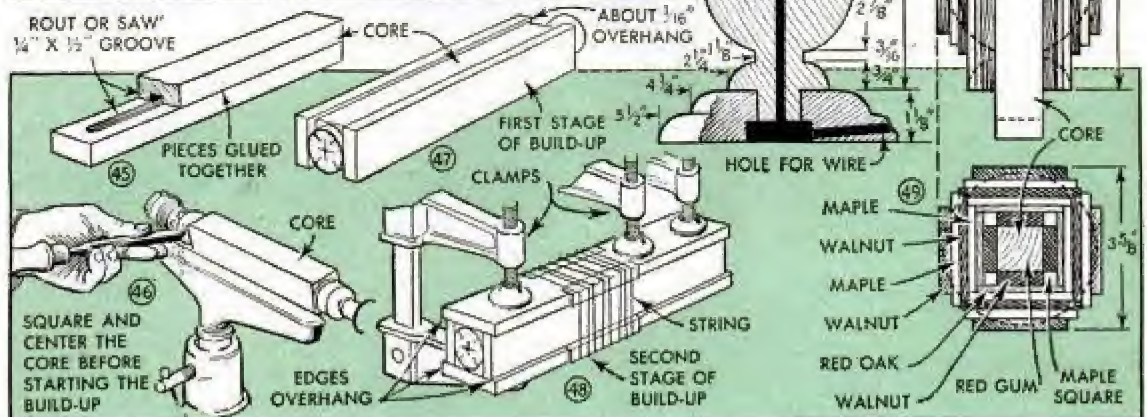
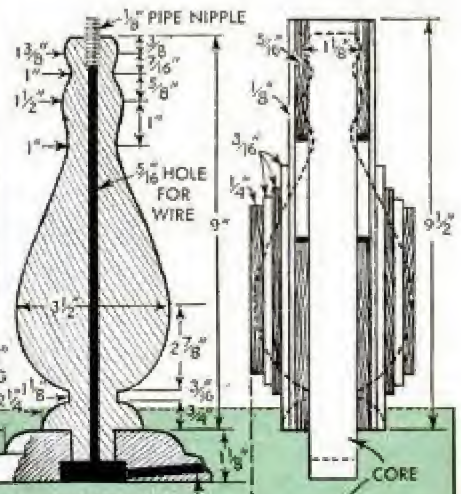
## Part Two



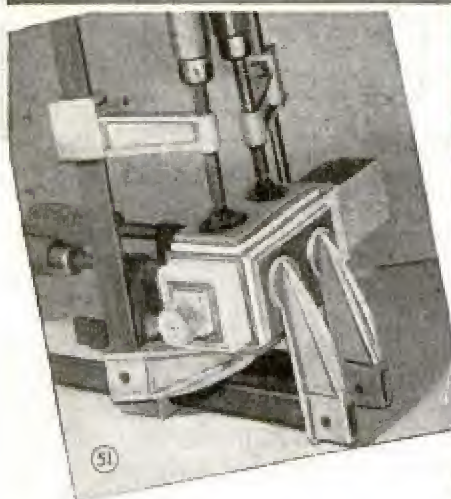
**POST-BLOCKING** gets its name from the fact that the work is built around a central stem or post. In its artistic form, built-up work of this kind does not differ greatly from conventional post-blocking used to build up wood for large spindle turnings, except that the woods in the build-up are selected for color contrast.

**Mechanics of post-blocking:** Mechanical operations involved are simple and should be learned by making a planned design before doing any creative work. A good practice piece is the lamp shown in Fig. 43. Dimensions of the project are given in Fig. 49, which also shows how the various layers of wood must be arranged around a central core. The first operation is to make the core. In this instance, the hole through core center for the lamp cord was run in after turning, as shown in Fig. 44. However, if suitable drills are not available, the core should be grooved centrally and glued

up in halves to form a square as in Fig. 45. Notice that the groove is stopped short of the end of work to provide solid stock for centering. After the work has been turned, it is a simple matter to drill from the ends into the groove. Fig. 46 shows an optional but worthy point in the build-up. Here the core is centered and

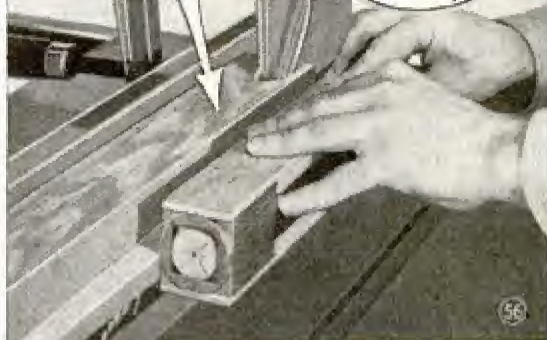
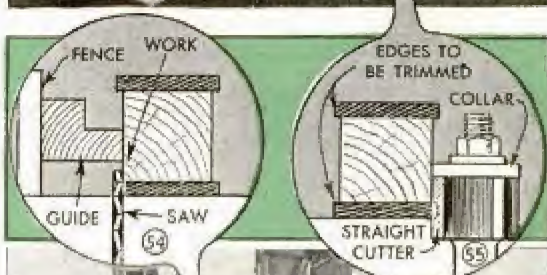
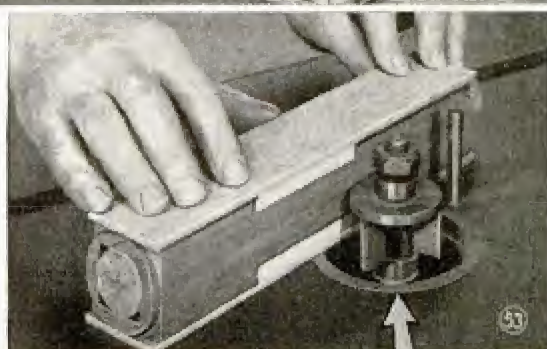




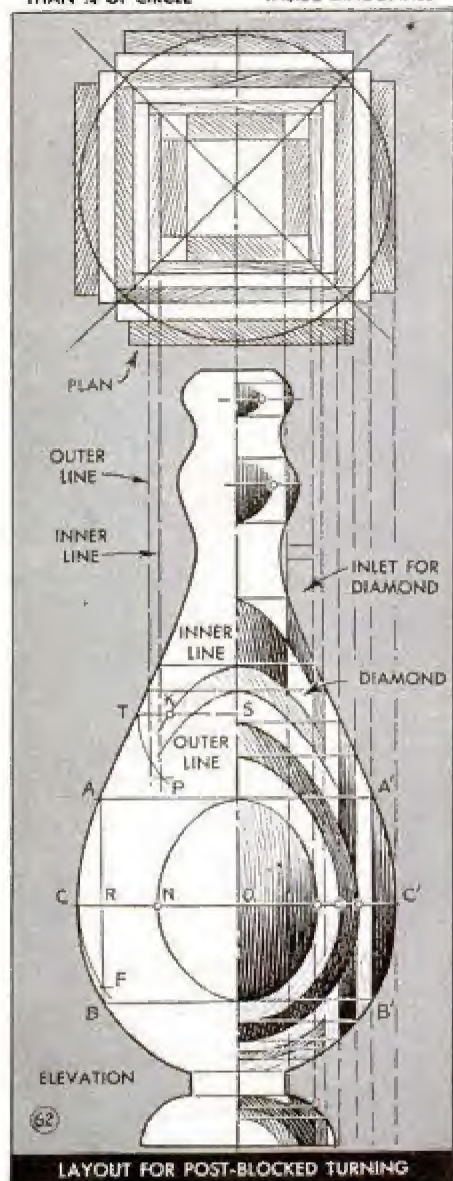
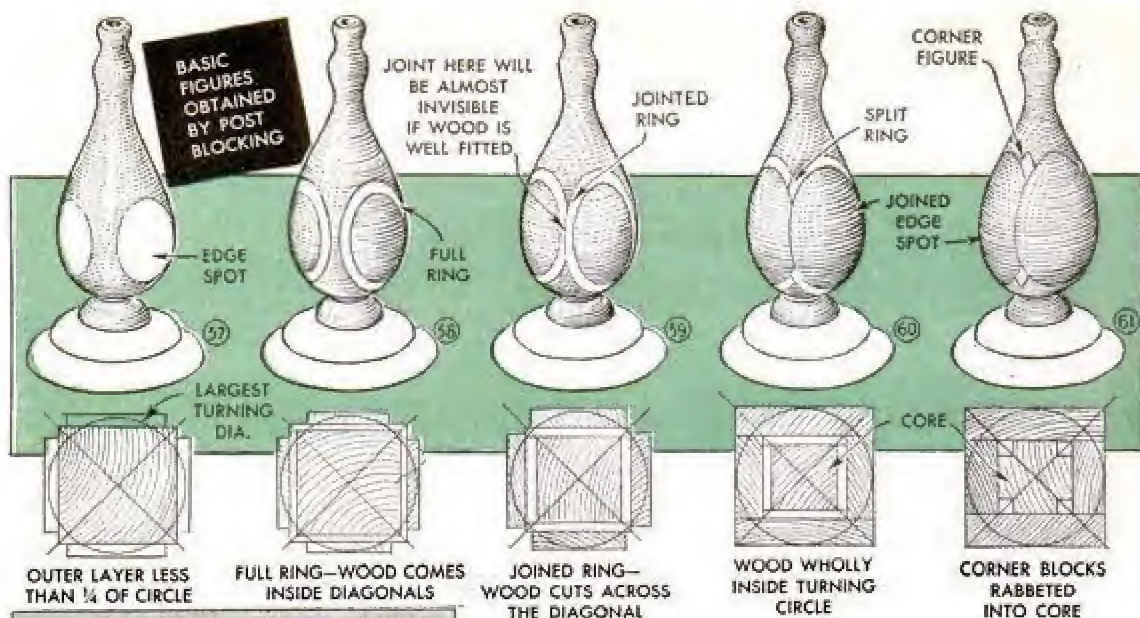


checked carefully before any layers of wood are glued to it. Exact centering of the work is important to avoid a lopsided figure. Fig. 47 shows the first set of blocks glued in place, with the edge slightly overhanging the core. After the glue has dried, the overhangs are dressed off flush to permit addition of the second pair of blocks, Fig. 48. In the same operation, the  $\frac{5}{16}$ -in. maple squares are tied into openings previously cut along the edges of the wood. After the glue has dried, the edges are again dressed flush to form a level surface for the third pair of blocks, continuing this procedure, a pair of blocks at a time, until the build-up is complete. Exceptions are the two outer layers. Since these do not overlap, they can be glued face to face at any time, and the double blocks can be fitted to all four faces in one gluing operation as shown in Fig. 51.

Throughout the build-up it is permissible to use small brads to hold the blocks in position so they will not slide when clamping pressure is applied. Needless to say, the brads should come in portions of the work well inside the turning. Any kind of glue can be used provided it holds tightly and permits a reasonable length of time to position and clamp the blocks. Turning the complete assembly follows standard practice. Fig. 50 shows sizing cuts run in, while Fig. 52 shows the work being finish-sanded.





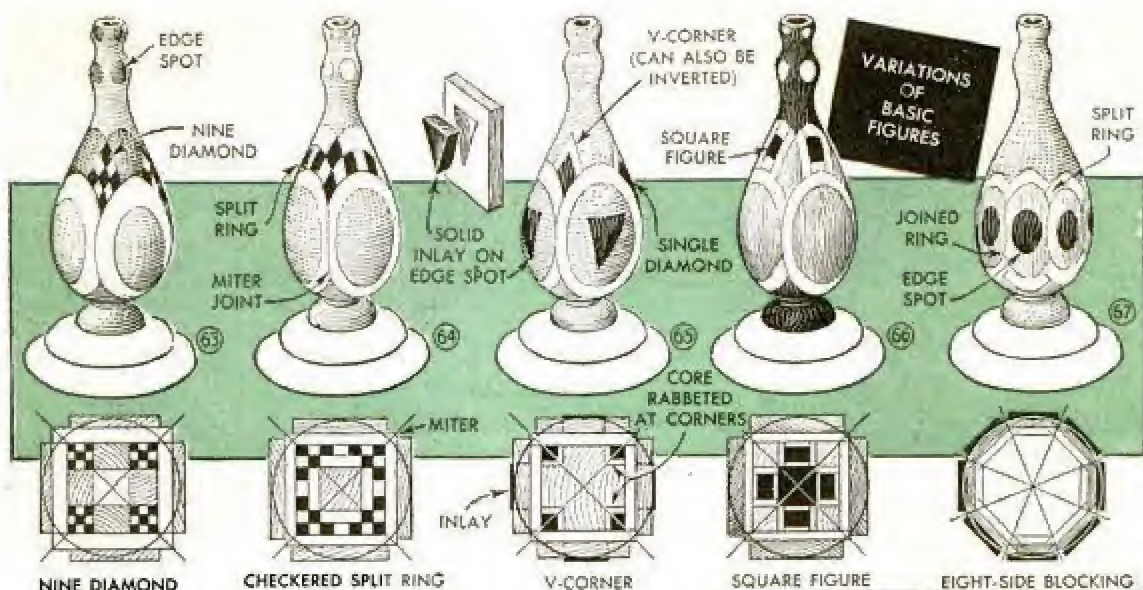


**Dressing overhangs:** It will be apparent that dressing the overhanging edges is the principal mechanical operation involved. Two good methods are shown in Figs. 53 to 56 inclusive, one using a shaper and the other a circular saw. The shaper method requires a straight cutter and guide collar of the same diameter. The work is guided along the collar, the cutter trimming the overhang exactly flush. The saw method requires a wood guide clamped to the regular fence. The guide is located exactly flush with face of saw, Fig. 54. When the work is pushed along the guide as in Fig. 56, the overhanging edge is sawed off flush. In each case, trimming should be followed by a very light jointer cut or a hand rub on a sheet of sandpaper over a perfectly flat surface, such as the saw table.

**Basic figures:** The six basic figures in post-blocking are shown in Figs. 57 to 61 inclusive, each example showing the build-up for a single figure, except Fig. 60 which illustrates both the split ring and joined-edge spot. The rules governing these figures are simple: Edge spots and full rings must come inside the diagonals of the turning square. The joined ring cuts the diagonal, the split ring is wholly inside the largest turning circle and the corner figures lie on the diagonals. Any shape of post-blocked work will show one or more of these basic figures. Projects can be planned to include as many of the basic figures as desired.

**Layout for original designs:** Creative work requires some sort of advance drawing in order to determine how the build-up will look when turned. This can be very elementary, or complete right down to the finished shape, as shown in Fig. 62. In all cases, start with the contour outline of the project, and above it draw the largest turning diameter and the diagonals of the turning square. The contour and plan are then sliced off layer by layer to form the basic figures. To determine the full shape of any figure, consider the edge spots shown in Fig. 62. The edge blocks cut the contour at points





A and B, marking the height of the edge spot. To obtain the width, draw line CC across the widest part of the turning. With center O and radius OC, describe an arc cutting line AB at point F. RF, then, is the half width of the edge spot, and is transferred with dividers to line CC, establishing the point N. With the limits of the figure thus set, it is easy to sketch in the approximate shape of the edge spot. Very exact work can be done by drawing additional guide lines across the turning. A second example in Fig. 62 shows the development of the split ring shape. The top limits of the ring will be marked by lines drawn from the plan intersecting the contour of the turning. Now, imagine you want to determine the width on line TS. With dividers at S and radius ST, describe an arc cutting the vertical line at P. Measure from P to TS and set off this dimension from S to establish point K. If you are not familiar with this type of drawing, you will find the layout a bit confusing at first, but actually it is not difficult, especially if you make the sample project first to use as visual evidence.

**Variations of basic figures:** Figs. 63 to 67 inclusive show variations of basic figures. In Fig. 63, the single diamond of the original design is enlarged and laminated to form a nine diamond. In Fig. 64, the split ring is laminated instead of being solid wood. Fig. 65 illustrates the use of solid inlays and the development of the V-corner. Fig. 66 shows the square figure, and Fig. 67 shows how basic figures look in an eight-side block. In most of these examples the design variation is pictured as being stopped inside the turning instead of running right through. This usually is good practice since intricate corner figures, etc., often show as mere slivers of wood if



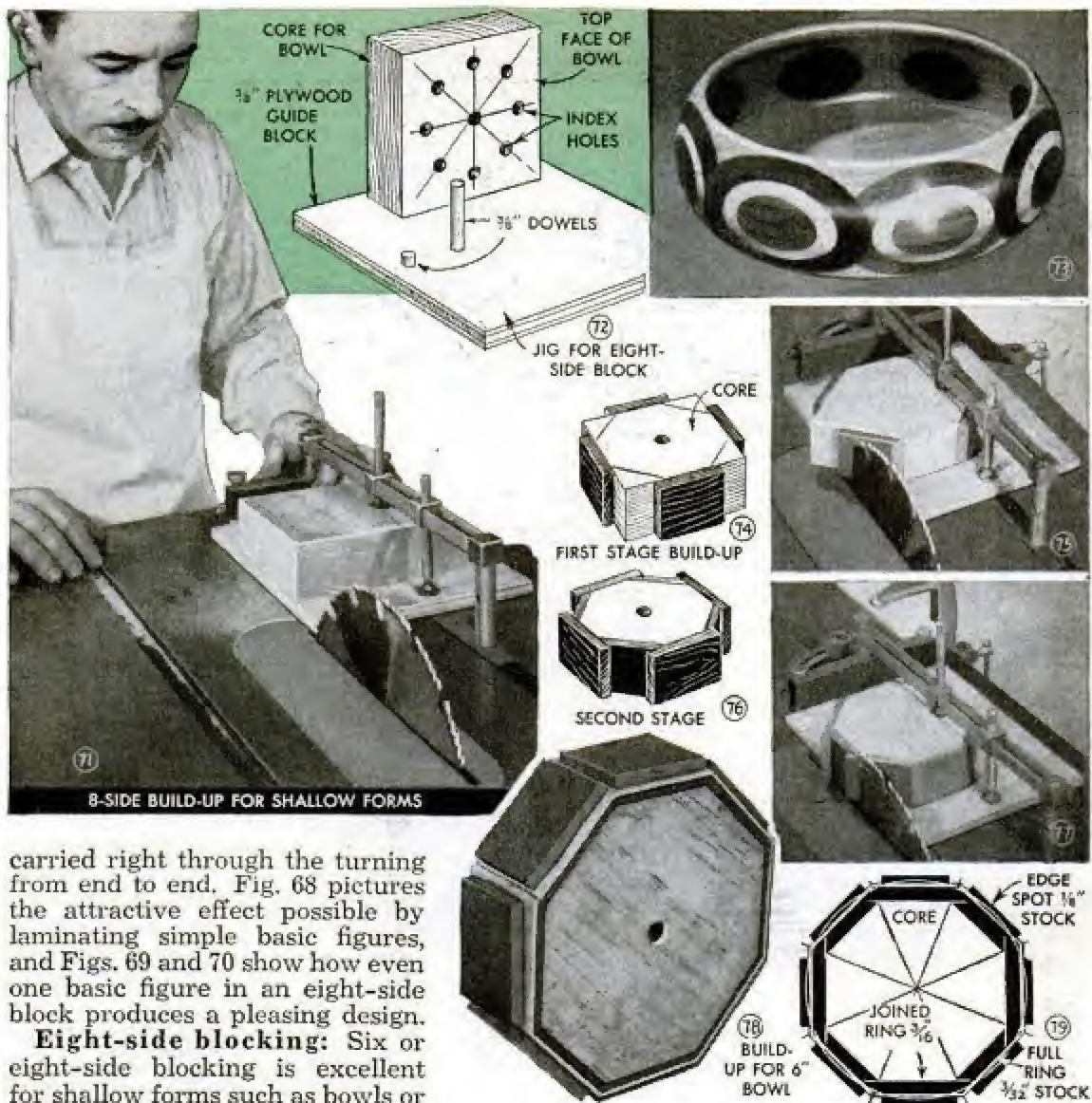
EIGHT-SIDED BLOCKING WITH FOUR  
PIECES OF JOINED RING  
LAMINATED WALNUT AND MAPLE



LAMP SHOWING SOLID INLAY  
ON EDGE SLOT, SINGLE DIAMOND  
AND CHECKERED JOINED RING







carried right through the turning from end to end. Fig. 68 pictures the attractive effect possible by laminating simple basic figures, and Figs. 69 and 70 show how even one basic figure in an eight-side block produces a pleasing design.

**Eight-side blocking:** Six or eight-side blocking is excellent for shallow forms such as bowls or boxes. Fig. 73 is an example of an eight-side block. The shallowness of the project permits a difference in working which is both simple and accurate. Start by cutting the square core a little oversize. Center the work in the lathe and use the dividing head to set off eight holes on the top face of the core, as in Fig. 72. Make a plywood guide block as shown, with dowel pivot and index pin to fit the holes in the work. Now, fit the work on the guide block and fasten this to the circular saw miter gage. Rotate the work four square to trim the core to net size, as shown in Fig. 71. Fit the first set of blocks in place, Fig. 74, then trim the corners of the core as in Fig. 75, which also trims the first set of blocks at the same time. Glue the second set of blocks, Fig. 76, then trim the first set to net thickness, Fig. 77, which also trims the ends of the second set of blocks. Proceed in the same manner until the build-up is

complete as in Fig. 78. Fig. 79 shows a plan of the build-up. It will be noted that the basic figures are the same as for a four-block. Very thin stock must be used to keep the full rings inside the diagonals. Turning follows standard practice, the work being inspected frequently to note how the figure is developing.

(Conclusion)

## Removing Spots From Wallpaper

Almost any grease can be removed from a papered or plastered wall with a paste made by mixing powdered China clay, 2 or 3 oz., with enough carbon tetrachloride to form a thick paste. With a table knife spread a layer of the paste over the spot to be removed, let it dry and then dust it off. Some spots may require a couple of applications.—Fred D. Johnson, Toronto, Can.





# 5 Shortcuts on SEWING MACHINES

Upper left: Using carbon paper, and a nail in the needle holder, a sewing machine provides a novel way of transferring a used embroidery pattern which no longer can be transferred by heat. The stamping, which is done with a heavy cardboard under the work, transfers tiny dots to the cloth. Above: Easily soiled curtain material can be kept off the floor when hemming it if a pillow case is attached to the edge of the machine to catch the work



Where much hemming is to be done, or where it may be objectionable to make holes in the material with pins, considerable time can be saved by using paper clips to hold the hem instead of basting it

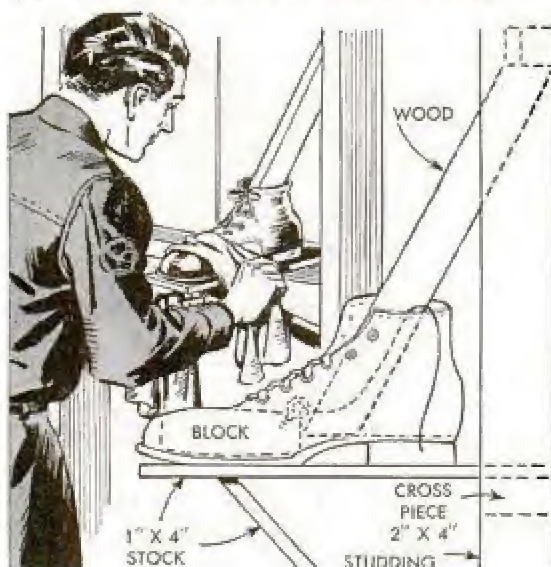


Above: To keep thread from unwinding too fast and becoming wound around the spindle when sewing at high speed, place a rubber washer under the spool to provide friction. Left: By using the presser foot of the machine as a hold-down when basting, you'll be able to do the work more quickly and with better results, as the cloth can be held tautly as it is stitched to assure the hem being straight and uniform





## Soldier Builds Rack in Barracks To Hold Shoe for Shining

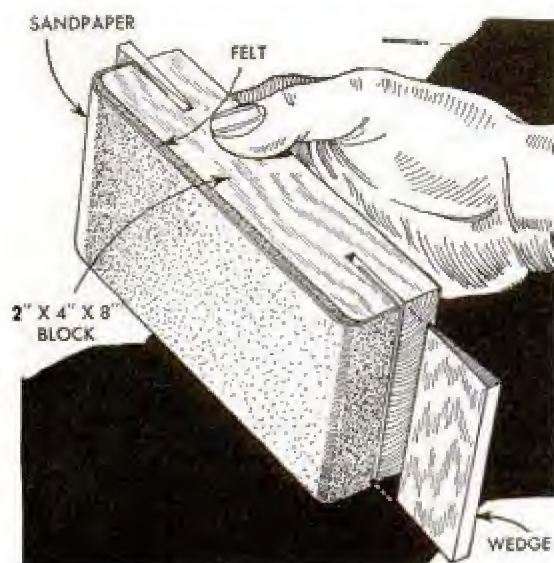


A soldier built this simple rack on the wall of his barracks to simplify the job of shining his shoes. It consists of an ordinary shelf projecting from the wall and a length of 2 by 4-in. stock, which is wedged between the shoe and a block nailed to the wall above the shelf to hold the shoe firmly on the shelf. If desired, a shaped block can be used in the toe of the shoe, using a string tied to a screw eye in the block for removing it. When held in the rack, a shoe is at a comfortable position for shining.

—Sgt. Frank J. Duca, Camp Pickett, Va.

## Paper Wedged on Sanding Block

Changing paper on this sanding block is just a matter of removing and inserting a couple of thin wedges. Made from a short

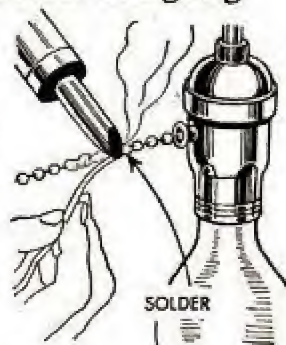


piece of 2 by 4-in. stock, the block is slotted at each end to receive the ends of the abrasive paper which is held by pressing a couple of thin hardwood wedges into the slots. Covering the bottom of the block with thin felt provides a smooth, resilient backing for the paper.

—P. B. Read, Chicago.

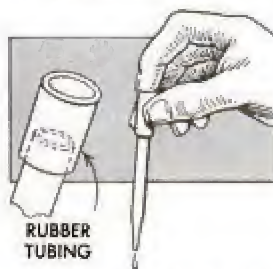
## Solder Stiffens Lamp Pull Chain To Keep It From Tangling

The annoyance of having the pull chain of a lamp socket snap upward and become entangled when released can be avoided by stiffening an inch or so of the chain close to the socket with a little solder.



## Rubber Tube Serves as "Bulb" On Medicine Dropper

When a medicine-dropper bulb cracks or breaks and another is not at hand, remove it and substitute a short piece of rubber tubing. In use, insert the dropper into the liquid, place the finger tightly over the end of the tubing and remove the dropper. The dropper will hold the liquid inside it until air is allowed to enter the tubing around the finger. Slightly loosening the finger pressure on the tubing will permit the liquid to escape a drop at a time.

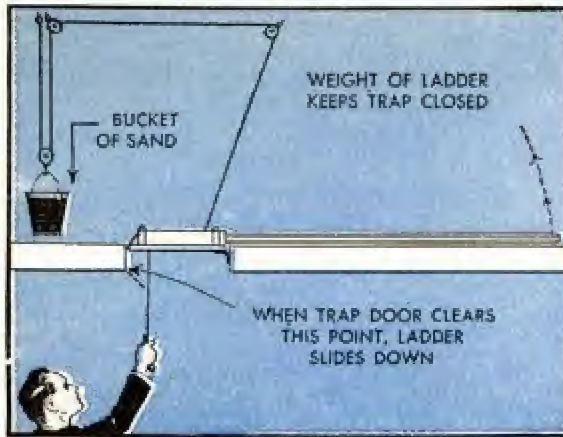


## Indelible-Pencil Marks Removed With Emery-Cloth Eraser

If you experience difficulty in removing indelible markings with an ordinary rubber eraser, try using one made of emery cloth. Just remove the eraser from a pencil, roll a narrow piece of emery cloth tightly and insert it into the ferrule. The fine emery wears away the paper surface, but does not break the fibers.

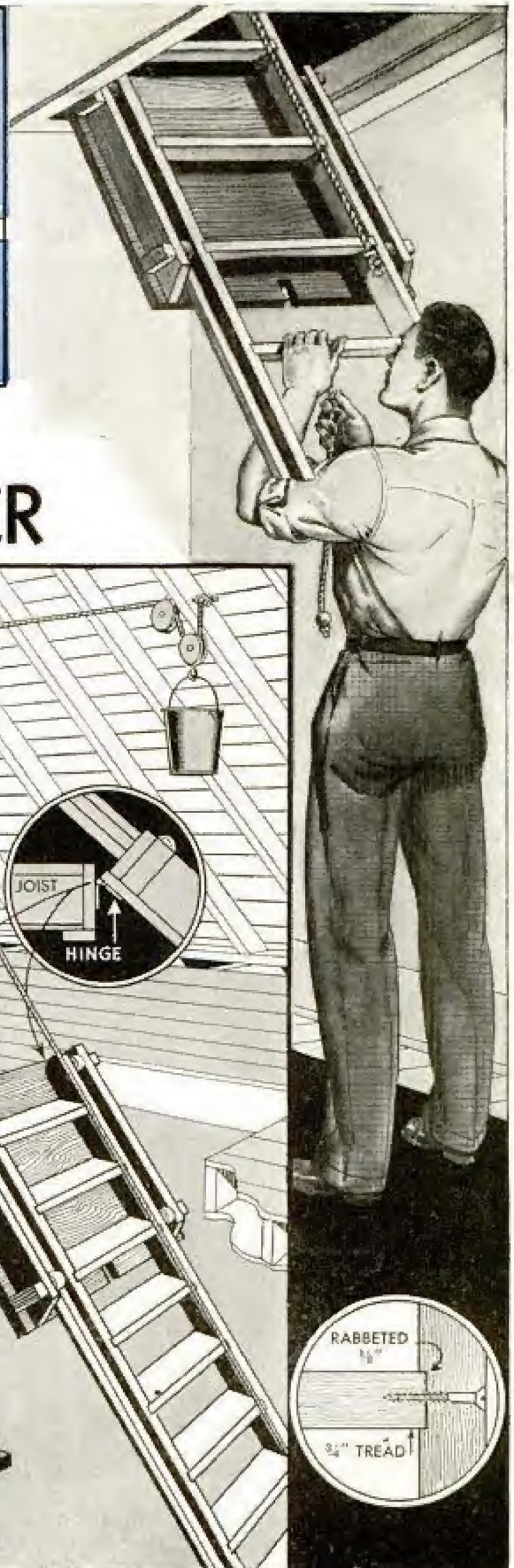
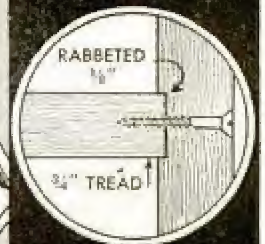
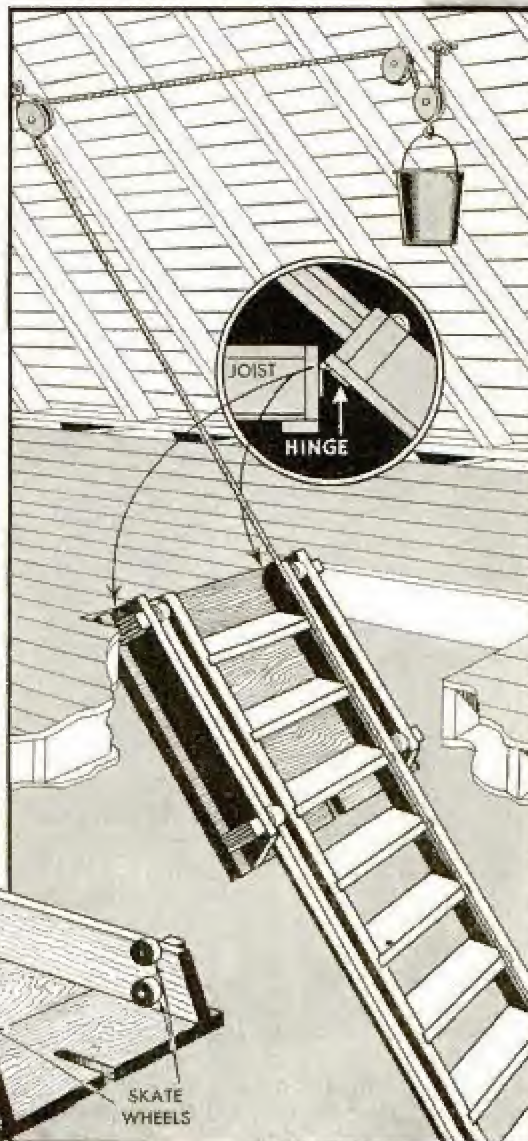
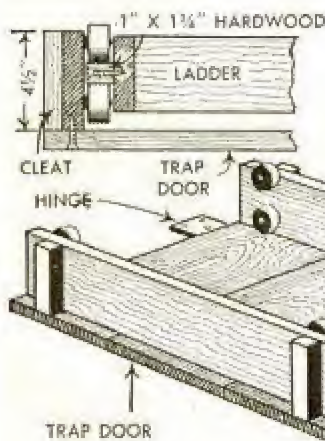






## Disappearing ATTIC LADDER

Critically counterbalanced and riding on ball-bearing skate wheels, this lightweight attic ladder is easy to raise or lower. By using a pail filled with sand as a counterweight, it's a simple matter to find the exact balancing point of the ladder. From the detail below you can see how sides are added to the trap door to which sets of skate wheels are fastened to engage hardwood cleats screwed to the sides of the ladder. The pulleys should be located high enough overhead to keep the pail of sand from touching the attic floor when the ladder is drawn up.



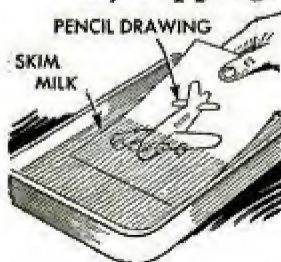


## Thread Spools Provide Holders For Card Writer's Brushes



Several empty thread spools glued to the back ledge of his work table were used by one card writer to hold his brushes conveniently at hand. The brushes are merely inserted into the spools as indicated.

## Pencil Drawings Made Indelible By Dipping in Skim Milk



Ordinary pencil drawings or writing may be made more permanent if they are submerged in a pan of skim milk for several seconds. After removal from the milk, they are

hung up to dry, and care should be taken that no moisture marks or streaks are allowed to form.

## Effective Rock Specimen Mounts Made From Caster Cups

Mineral collections are displayed inexpensively and to great advantage if the individual specimens are mounted on glass caster cups. Set in plaster of Paris, which is poured into the base of the caster, the specimens are held permanently in the best position to show their distinctive features. With an identifying label pasted on the side of the



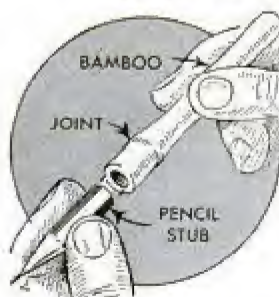
caster cup and another, carrying collecting data, on the bottom, each specimen is complete. Available in various sizes and colors, the caster cups can be used with a wide variety of rocks.

## Finger Rings Kept Safe on Hairpin While Washing Hands

For women whose finger rings must be removed before washing the hands, the following simple trick keeps this jewelry from being mislaid, forgotten or stolen in a public place, or from washing down the drain: Remove a hairpin from the hair; put all the rings on it and replace it firmly in the hair again. In this way the valuables are never laid aside and forgotten.



## Pencil Stub in Bamboo Holder Is Good to Last Bit



Pencils can be used much longer than would ordinarily be possible if they are slipped into bamboo holders. Take a piece of bamboo with an inside diameter to fit snugly on a pencil and cut it about  $\frac{1}{2}$  in. from

the joint. One that has an inside diameter slightly smaller than a pencil can be reamed out with a tapered reamer, which gives the advantage that the pencil will be gripped firmly. Leave enough on the opposite side of the joint to make a good grip for the hand while writing.

## Sinker Is Handy Punching Anvil For Modelmaker's Small Parts

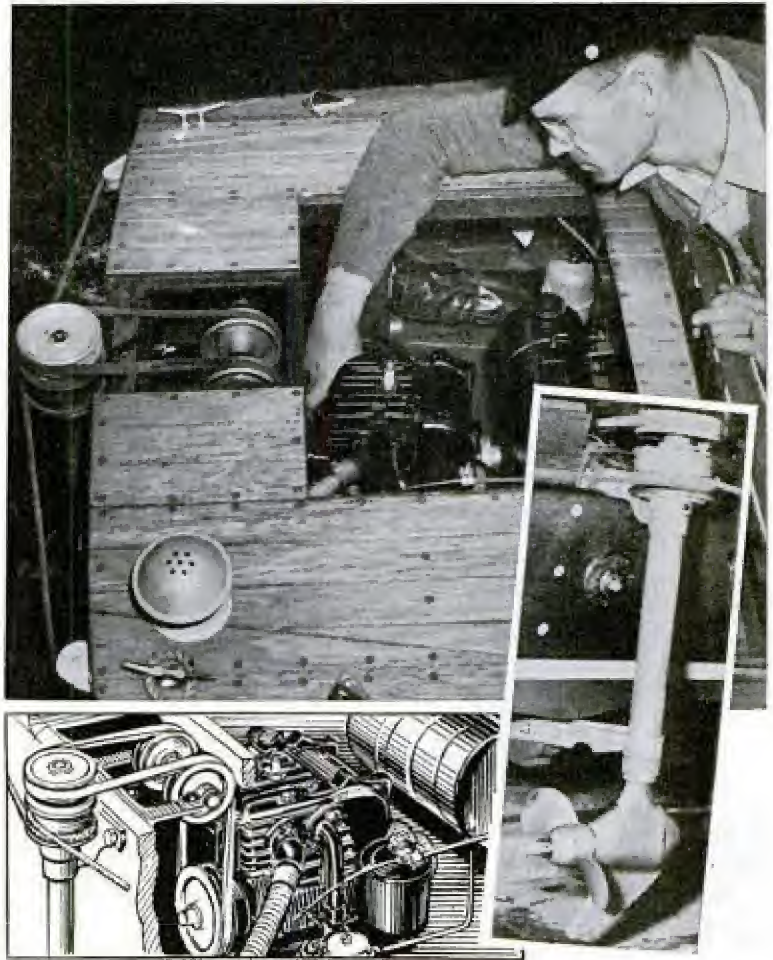
Modelmakers will find that a flattened lead fishline sinker provides a handy anvil when punching holes in thin metal. The sinker is attached to the bench with tacks inserted through the wire eyelets.





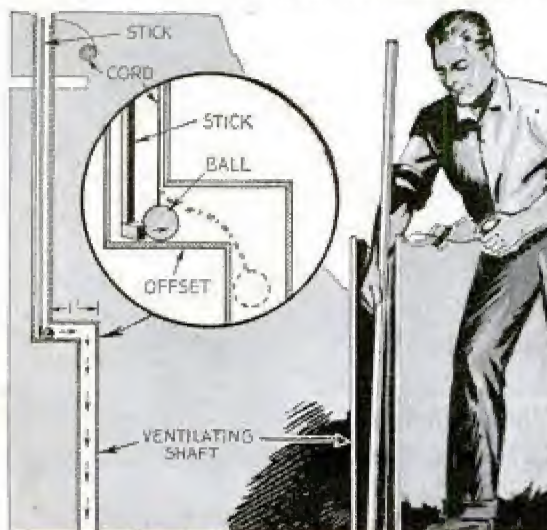
# Small Boat Driven by Washing-Machine Engine

Practically all the advantages of an outboard motor with none of its disadvantages are claimed by the builder for this small inboard job. It is economical and is light enough for the smallest boat, and consists of an air-cooled engine of the washing-machine type belted to the shaft-and-propeller assembly of a discarded outboard motor. An unusual feature is that the driver can bring the boat to a complete stop and back it up simply by turning the steering wheel. This is possible because the rudder rope is wound around the outboard shaft housing, making it possible to rotate the propeller through a complete circle. The stock engine muffler, which is mounted on an exhaust pipe outside the boat, reduces the usual outboard noise. The engine is cooled adequately by means of ventilating holes drilled through the forward bulkhead. The propeller-shaft assembly is pivoted to the boat stern by means of suitable brackets as shown in the lower right-hand detail. A pulley of a size to rotate the propeller at three times the engine



speed is fitted to the upper end of the propeller shaft, and is belted to the engine, the belt running over two idler pulleys as shown in the lower left-hand detail.

## Easy Method of Running Wires Through an Offset Shaft



The problem of running wires through a narrow ventilating shaft, which contained an offset, to install a telephone in my third-floor dormitory room, was solved in the following way: A tennis ball was taped to one end of a long, strong cord and let down the shaft to the offset. Then, a long stick having a short arm attached at right angles to the end, was lowered into the shaft to the offset, after which a twist of the stick knocked the ball from the offset so that it dropped to the bottom of the shaft. By removing the ball and tying the cord to the wires, it was then a simple matter to pull them up through the shaft. Of course, this idea can be used only where it is possible to gain access to the upper end of the ventilating shaft.

—John E. Keyes, Princeton, N. J.



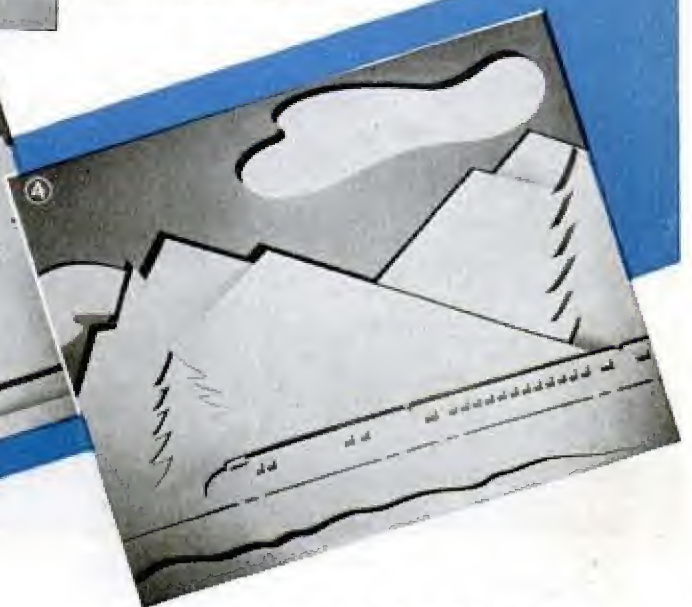
# PHOTO SUBJECTS

By  
Fred G. Korth

Humorous paper cutouts offer new possibilities for unusual invitations, announcements and greeting cards

WITH the use of paper cutouts as props in making tabletop scenes to photograph, you can exaggerate, inject humor and even emphasize abstract ideas—something that is almost impossible to do with a camera alone. Practical applications are distinctive greeting cards for birthdays, holidays and other occasions, invitations to parties, announcements, movie titles, bookplates, restaurant menus and attention-getting pictures for advertising purposes.

About the simplest type of photo cutouts are illustrated in Figs. 3, 4 and 7. These suggest an auto ride in the city, a train in the mountains and a sailboat, all done in





# Cut from Paper

unconventional modern lines. The effects are obtained largely by means of shadows, one cutout being placed in front of another, with sufficient space between them to get desired effects. The cutouts may be laid down horizontally on a table, small blocks being used to separate them as shown in the inset above Fig. 7, or they can be arranged vertically. In the latter case blocks may be glued to the reverse side to serve as supports or the cutouts themselves may have extended bases which are bent over to hold them upright. Generally the vertical arrangement gives the photographer greater flexibility in manipulating his camera, whereas the horizontal arrange-



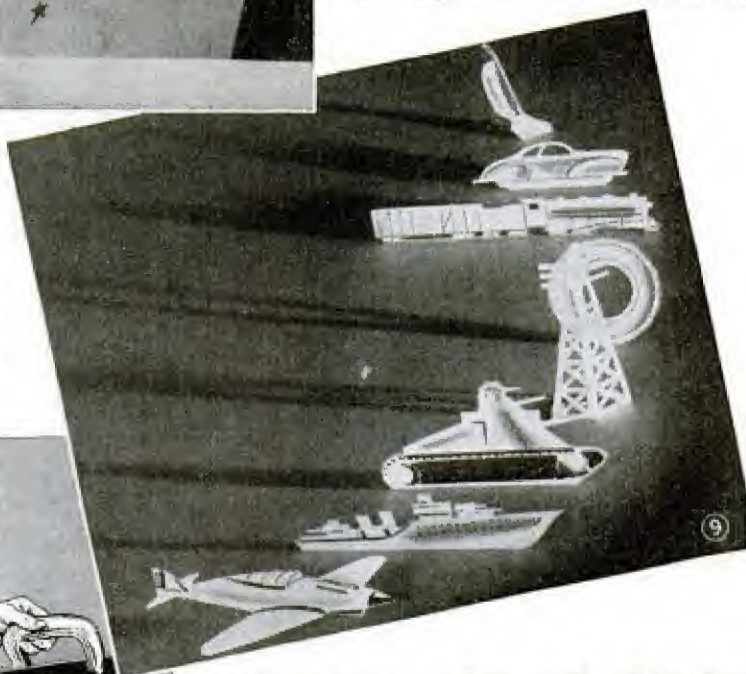
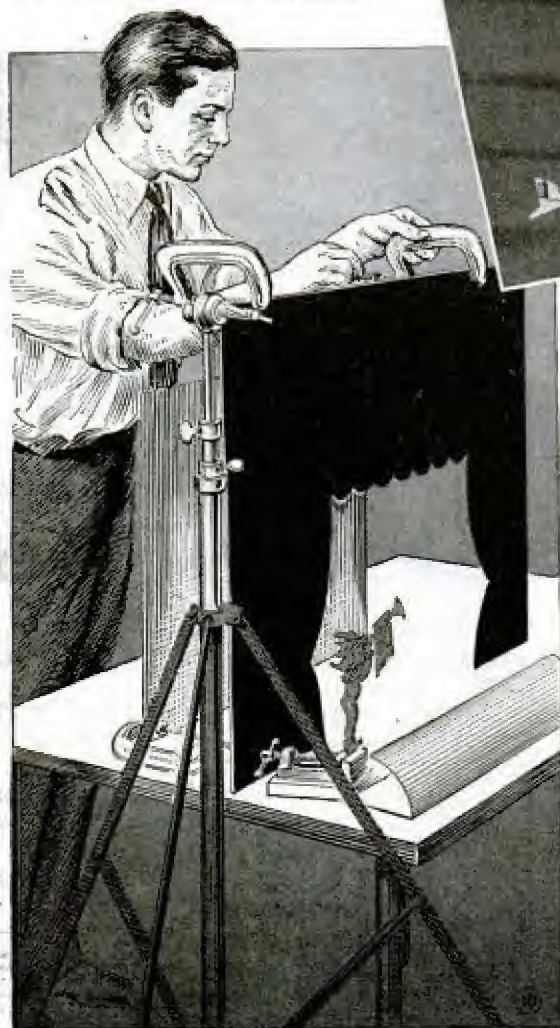
ment makes it necessary to have the camera pointing downward for which special facilities are required.

To produce photo 1, which provides a novel picture on an invitation to a housewarming party, the cutouts were handled like objects on a movie lot. Fashioning a paper house having a roof and two sides is all that is necessary to obtain the three-dimensional effects. Note that the picture is made without exactness of proportions, in order to get simple but striking effects that are more decorative than realistic. A model house made in great detail, with a natural appearing tree and





For home-movie titles, you can set up a paper stage with curtains bearing the titles. If desired, cut-out figures may be placed as shown in Fig. 8 to lend additional interest to the title picture. Details of arrangement are shown in Fig. 10. The "proscenium" is clamped to an arm bent at right angles and held by a lamp standard



inside openings a sharp, pointed knife is best, as shown in Fig. 2. To follow the original penciled outlines and still keep the paper clean for photography, draw the designs in reverse and bend the pieces so that the clean side is exposed to view. Whenever important parts of white paper cut-outs are placed in front of others so that the individual pieces do not stand out sufficiently, you can use paper of slightly different shades, or you can do some shading with crayon, soft lead pencil, brush or airbrush. Shading with pencil was resorted to in making the woman's hair contrast with the house in Fig. 1. Her face and figure stand out in relief against shadow and need no shading.

Fig. 5 is an invitation to a quiz party. Like Fig. 1, the subjects were cut out of white drawing paper and bent to shape. Bending paper is an easy way to introduce depth although a little airbrushing or shading with pencil will help where bending is not feasible. Sharp bends such as are needed to simulate a book and parts of a bench or desk, are made after scoring the paper with a knife. The round front of the globe



is held in shape with a paper ring. A black card with white lettering represents a blackboard.

In some cases paper cutouts can be used in conjunction with real objects if the latter are small enough to be included in the picture, as for instance in Fig. 6, which depicts paper chefs preparing a salad. Here the actual vegetables, a knife, a spoon and even a page from a cook book are shown. Such a picture on a menu, cook-book "jacket" or in an advertisement helps to make it distinctive. Another popular application of cutouts is the making of home-movie titles, an example of which is shown in Fig. 8. The setup consists of a dull black paper proscenium with a light paper "curtain" behind it, on which the lettering is carried. The opening title may well include the photographer's name. A little trumpeter is placed at one side where it will be in good contrast. Note in this case how the trumpeter has been shaded for extra detail. To hide the uneven lines at the bottom, a paper "ramp" slightly wider than the scene was set directly in front of it. Fig. 10 illustrates how the proscenium was held to a crosspiece by means of two C-clamps, the crosspiece being a metal rod bent at right angles and inserted in a lamp standard. The piece of cardboard serving as the curtain is held with a C-clamp attached to its lower edge and laid on the table.

"Priorities" is the subject of Fig. 9. The various objects such as the airplane, destroyer, tank, etc., were cut out of paper and set up in a pleasing arrangement. The plane was held by a pin while the base of each of the other parts was bent back to make it stand upright. Small blocks glued to the parts also could serve the purpose. When the arrangement was completed, a spotlight was placed on the right-hand side to produce long shadows, which gave a three-dimensional effect, although the cutouts were perfectly flat. The unusual photo shown in Fig. 11 represents a grocer removing a can from the top of his stock. Here the paper models were laid down on blocks which separated them from a col-



ored background. The third dimension was real in this case as the stacks of cans are three rolls of paper with lines and slight shading to simulate individual cans. Lighting from both sides helps to give depth.

### Iodine Removes Spots on Prints

Tincture of iodine will remove black spots on a print caused by pinholes in the negative. Apply a tiny bit of iodine to the spot with a fine-pointed brush, then a bit of plain hypo, and the spot will be gone.





## Carpet Tacks Remove Sediment Inside Developer Bottle



Hard-to-remove sediment that collects in bottles used to store developer can be cleaned out easily with a handful of carpet tacks. The bottle is half-filled with warm soapsuds, the tacks poured in, and the bottle shaken vigorously.

## Cork Protects Tank From Dust

Before putting away a developing tank after using it, wash and dry it and place a cork in the opening in the lid. This will keep dust from entering the tank while it is idle and it will be clean and dry when you want to use it again.



## Oatmeal Box Straightens Prints



I have found that curled glossy prints can be straightened in about an hour by rolling them face-side-out and placing them in a round carton such as used for oatmeal. A rolled magazine placed inside the prints forces them

against the outside of the box. Several prints can be treated at the same time in this manner.

—F. N. Vanderwalker, Flossmoor, Ill.

## Cellulose Sponges Kept in Water Remain Clean and Soft

Cellulose sponges used to wipe surplus water from negatives should be kept in water at all times. This keeps the sponges clean and soft with no possible rough edge to scratch a negative. Screw-top glass jars are handy for this purpose.

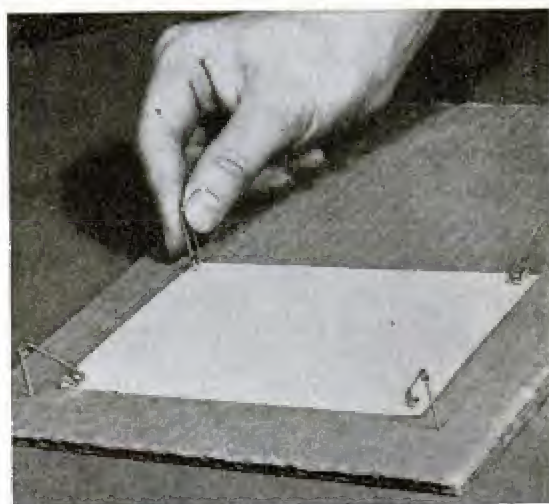


## Preparing Photos for Lettering

Before lettering a photo, prepare the surface by rubbing it lightly with a small swab moistened in water. When the surface feels slightly "tacky," it is ready for lettering. India ink used in a number 303 lettering pen point is recommended, but almost any good ink and fountain pen will do. Similar treatment is ideal for photo surfaces to be tinted with transparent water colors or for airbrush retouching.

## Four Safety Pins Hold Print Flat On Cardboard While Drying

Four safety pins can be used to hold a photograph flat on a piece of cardboard while it is drying. No holes will be made in the print if the pins are used as shown as the spring of the pins pressing the rounded heads down on the corners of the print will hold it in place.







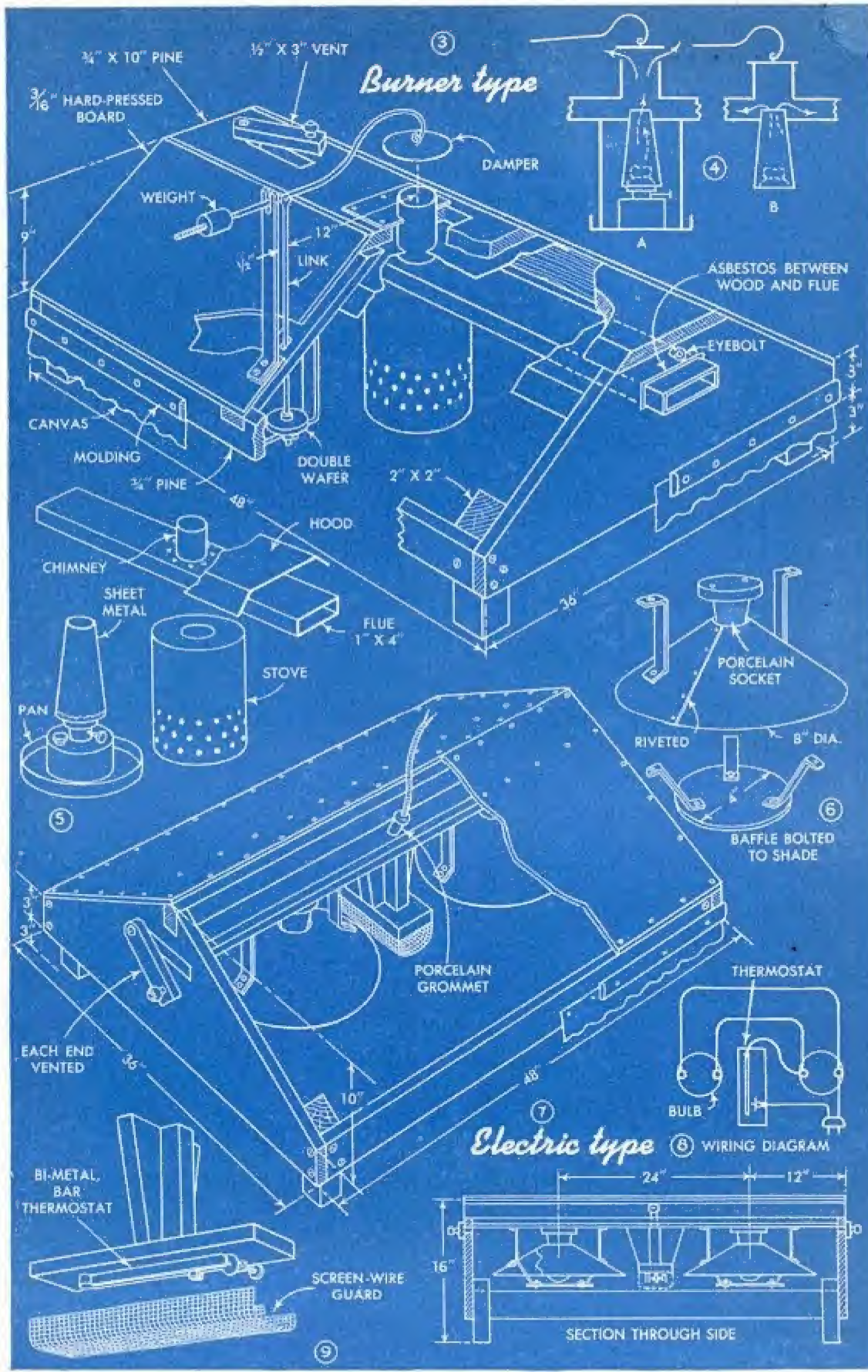
# SHOP NOTES



**I**T'S neither difficult nor expensive to build one of these chick brooders, which are controlled automatically to maintain a given temperature inside the brooder. A burner type is pictured in Figs. 1 and 2 and an electric type is shown in Fig. 7. Both brooders are controlled by thermostats assembled and used like those on the electric and kerosene incubators described in the previous issue of Popular Mechanics.

The electric brooder is made of pine and hard-pressed board assembled as indicated in Fig. 7, which also shows the skirt, the positions of the vents, and how the electric cable enters the brooder through a porcelain grommet. The skirt should clear the floor by  $\frac{1}{4}$  in., and should either be scalloped or cut in strips to permit the chicks to get in or out easily without exposing the brooder to too much floor draft. The heat-







ing system consists of two bulbs and a bi-metal bar thermostat connected as shown in the wiring diagram of Fig. 8. The latter also shows the positions of the bulbs, which are covered with shades and baffles of black sheet iron assembled as in Fig. 6. The thermostat is located between the bulbs and clears the floor by 6 in. It is shielded with screen wire as indicated in Fig. 9, one end of the wire being open to permit adjustment.

Construction of the hood or enclosure for the burner type of brooder is similar to that of the electric type except that it is flat at the peak and is provided with a pair of rafters in the center. Vents on this model are on top instead of in the gables. The brooder is heated by an ordinary kerosene lamp, and the temperature is regulated by a damper arrangement, which is actuated by an expanding wafer. The thermostat arrangement is the same as that of the kerosene incubator, except that the heating is direct without a water radiator. When the temperature inside the brooder drops below that for which the thermostat is set, due to free exit of the heat through the chimney as indicated by detail A in Fig. 4, contraction of the wafer allows the damper to drop down on the chimney and cause the heat to pass through the horizontal sheet-metal flues as in detail B. Positions of the flues and general assembly of the hood, or enclosures, are shown in Fig. 3. Assembly of the heat-control mechanism also is shown. With the connecting link close to the fulcrum and a long arm for the damper, a very small expansion or contraction of the wafer causes considerable travel up or down by the damper. The horizontal flues with the chimney are fixed in the brooder, the flue ends being insulated with sheet asbestos where they pass through the wood ends of the brooder. A flanged hood rests on top of the flues to direct the heat downward.

All sheet metal work must be riveted, brazed or welded at the joints. Fig. 5 shows the flue with chimney, flanged hood, "stove" and pan, as well as the sheet-iron chimney for the lamp. When lifting the brooder off the lamp, a sandbag counterbalance will be a great convenience as shown in Fig. 1. Note that the stove with the lamp inside it is not secured to the flue, but remains on the floor when the brooder is lifted. The flue rests on top of the stove, and has an opening to receive the top of the lamp chimney.

The brooders should be operated about 24 hours before the chicks are placed in



them, and they should be operated in a room, basement, garage or brooder building where the temperature can be kept high enough to avoid too great a difference between temperatures inside and outside the brooder. Temperature under the brooder itself should be 92 to 95 degrees at the edge under the canvas skirt. It will be warmer, of course, near the stove or directly under the bulbs of the electric model, but chicks can move freely and will instinctively go to the part of the brooder that is the most comfortable. Temperatures can be reduced two or three degrees each week until the seventh week, after which a temperature of 70 to 75 degrees should be maintained until outside temperatures make artificial heat unnecessary. Cover the floor under and around the brooder with  $\frac{1}{2}$  in. of clean sand and spread peat litter, straw or similar material over it to a depth of about 1 in.

## Renewing Old Whetstone

Old whetstones may be renewed if they are dressed down level by scouring on a sheet of coarsest aluminous-oxide cloth. Use water, not oil, during this process. Mount the thin strip of stone remaining in a hardwood block soaked in boiled linseed oil. Use only clean water when sharpening tools, and stone the full length to avoid hollowing the center. As the stone fills up from use, scrub it frequently with water and pumice, using a stiff brush.



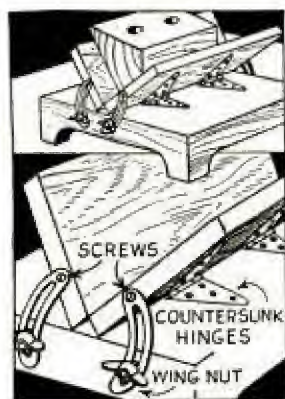
## Chisel to Cut Sheet-Metal Drums Made From an Old File



You will find a chisel like the one shown very handy when cutting old oil drums and other cylindrical objects of sheet metal. Made from a discarded heavy file, the chisel has a half circular cutting edge that makes it easy to hold the file against the work. Instead of beveling the cutting edge like that of a cold chisel, it is ground square or at right angles to the surface of the file. This method of grinding makes it easier to follow a guide line, as both sides of the cutting edge produce a shearing action. There will be a slight waste of material in the form of a shaving of the same width as the chisel. The tang of the file is broken off to provide a good hammering surface.

—R. York, Chicago.

## Large V-Block Easily Adjusted For Various Types of Work



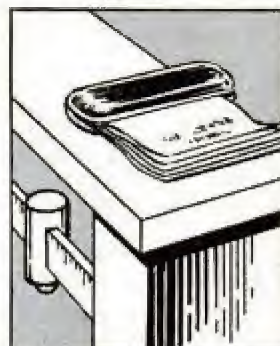
drilling as shown in the upper detail. The block consists of two hardwood blocks hinged to a suitable base so that they form

One mechanic who often had to drill work that varied over a wide range of diameters made up a V-block like the one shown that could be instantly adjusted to accommodate the work at hand. Also, the block was found handy to hold work of irregular shape for

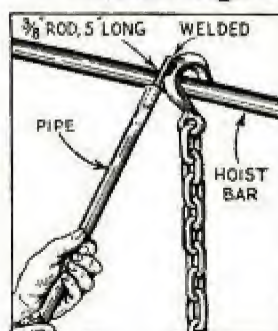
a V-shape when raised. Curved, slotted metal pieces at each end fit over bolts in the base to lock the adjustment.

## Spectacle Case Grips Weight Slips To Prevent Scattering by Wind

An old spectacle case of the type that has a spring-hinged cover is ideal for gripping small papers where they might be scattered by the wind. As an example, one shipping clerk has a case screwed to the top of his outdoor scales to hold weight slips. Another example is an auction clerk, who uses a spectacle case to hold paper currency when making change at sales held outdoors.



## Handle to Hook Chain Hoist Over High Bar or Beam



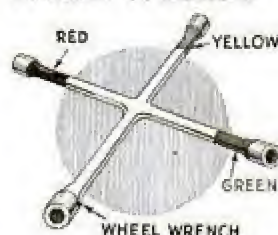
floor. The handle consisted of a short rod welded to the hook as shown to slip in the end of a suitable length of pipe.

Instead of using a ladder every time it was necessary to suspend a chain hoist from a bar or beam overhead, one auto mechanic fitted the chain hook on the hoist with a handle so that the hook could be put in place from the

## Selecting Right Socket by Color On Four-Way Wheel Wrench

The annoyance of hunting for the correct size socket on a four-way wheel wrench can be avoided by painting a different color band on each socket shank.

Memorizing the color of each socket will enable you to select the desired one instantly. If most of your work is done on only three or four cars of different models or makes, then the markings on the wrench can be identified with the make of car using each particular socket.





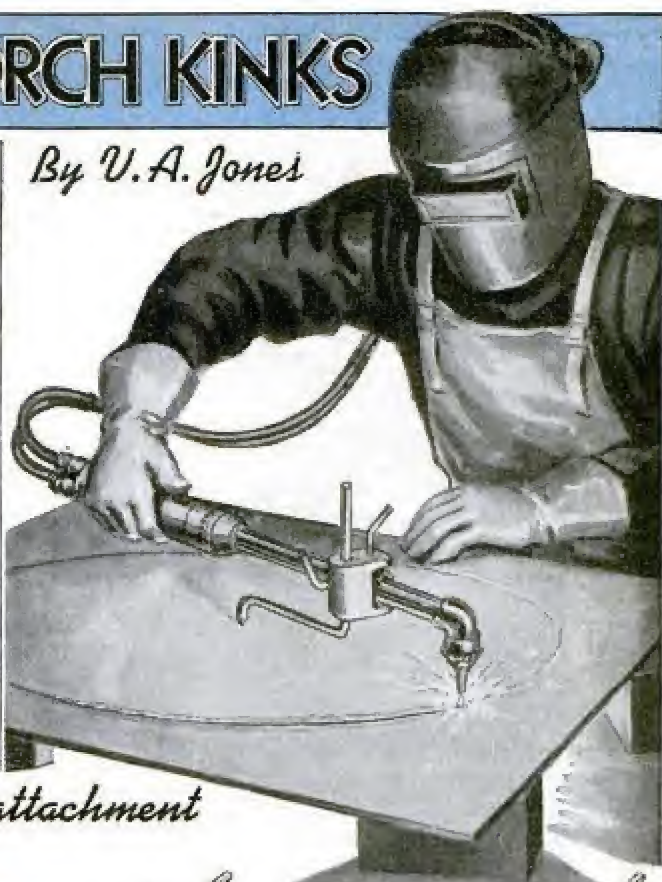
# CUTTING-TORCH KINKS

By U. A. Jones

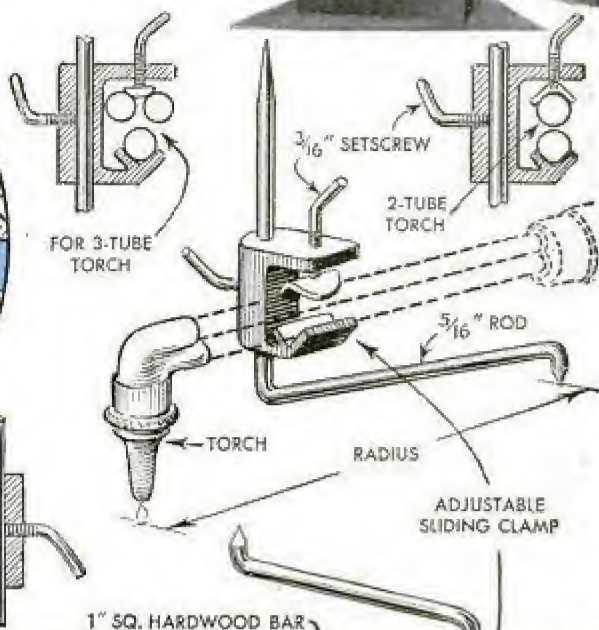
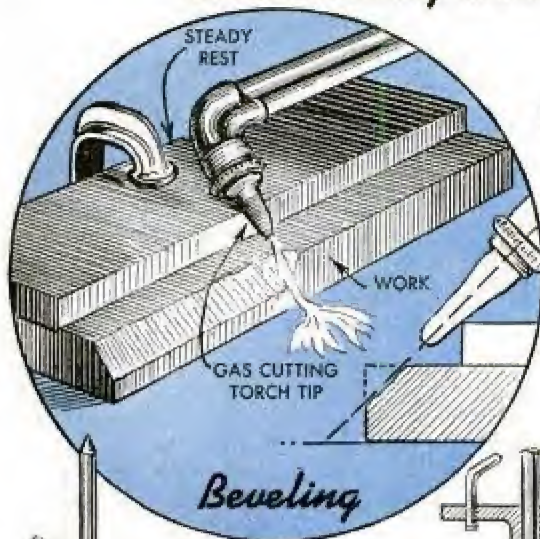
## CIRCLE-CUTTING ATTACHMENT—

Clamped to an oxy-acetylene cutting torch as shown, this attachment, which can be adapted to fit two or three-tube torches, provides an adjustable center point that makes accurate circle cutting a matter of moving the torch around like a compass. As the welder does not have to watch the burning-line as closely as when cutting freehand, he is less likely to inhale the fumes from the torch flame. The pointed rod is held in a punch mark made in the work, and the size of circles possible is limited only by the length of the torch tubes.

**BEVELING**—Ragged bevels that result from inability to hold the torch steady freehand are overcome by clamping a straightedge parallel to the edge of the work as shown below, against which the torch tip can be guided as it is drawn along



## Circle-cutting attachment



**TRAMMEL POINTS**—The circle-cutting attachment will serve double duty as a trammel point when clamped to one end of a hardwood stick as shown at the right, the opposite end of the stick being fitted with a similar point, except that it is made without the V-notch at the bottom and has a straight, pointed rod

## Trammel points

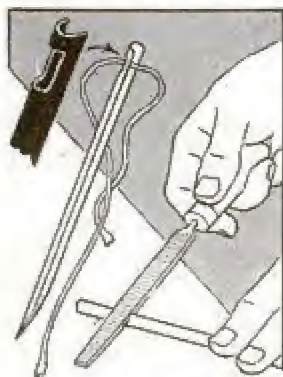


## Papering Brush Hung on Table Saves Paste, Avoids Disorder



To save paste and avoid messing the papering table or the paper itself by laying his brush upon them, one paper hanger provided the brush handle with a screw-eye and the table with a hook so that the brush could be suspended, as shown, to drain into the pail when not being used.

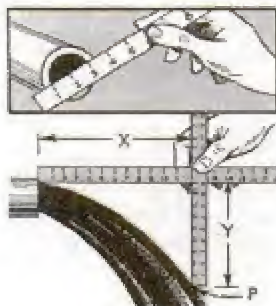
## Sack Needle From Umbrella Rib



Requiring a stout needle to mend grain sacks, a farmer made one from a discarded umbrella rib. A 6-in. length of the rib was ground to a sharp point at one end and filed across the curved edge to form an eye for the twine.

## Easy Method of Measuring Liquid Flowing Through Pipe

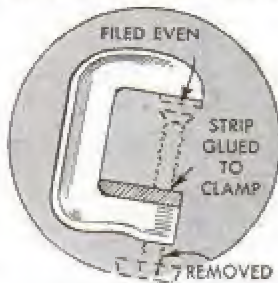
You can compute with surprising accuracy the flow in gallons or cubic feet per minute of water, oil, gasoline, etc., issuing from a horizontal pipe by the following rule: Multiply the squared inside di-



ameter of the pipe by distance X. Multiply this result by 2.56 and then divide by the square root of distance Y. As an example, assume that the inside diameter of the pipe is 2 in., distance X is 20 in. and Y is 25 in. Therefore, 2 squared is 4, which, when multiplied by 20 equals 80. Multiplying this by 2.56 equals 204.8, and then dividing by the square root of 25, which is 5, we get a flow of 40.96 gallons per minute. If the flow in cubic feet is desired, divide the number of gallons by 7.5 as there are approximately 7.5 gals. in a cubic foot of liquid. When making the measurements be sure that distance X is projected horizontally from the top surface of the water at the pipe. Also, you can simplify the problem if point P is located so that distance Y is 9, 16, 25 or 36 in. as the square roots of these numbers are exactly 3, 4, 5 and 6.

—W. F. Schaphorst, Newark, N. J.

## C-Clamp Used as Type-High Gage



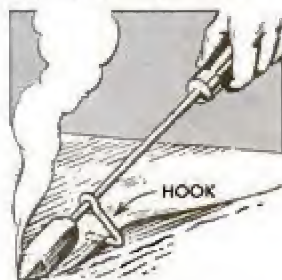
A type-high gage for use in a composing room can be made inexpensively from a ten-cent C-clamp. Select a clamp that has as nearly as possible the desired jaw spacing and remove the

screw. Then attach a strip of metal or hardwood to one jaw, as shown, to produce the exact spacing desired between the jaws. If the face of the other jaw is rough or irregular, it should be filed flat and smooth before applying the spacing strip.

—Albert Stewart, Kansas City, Mo.

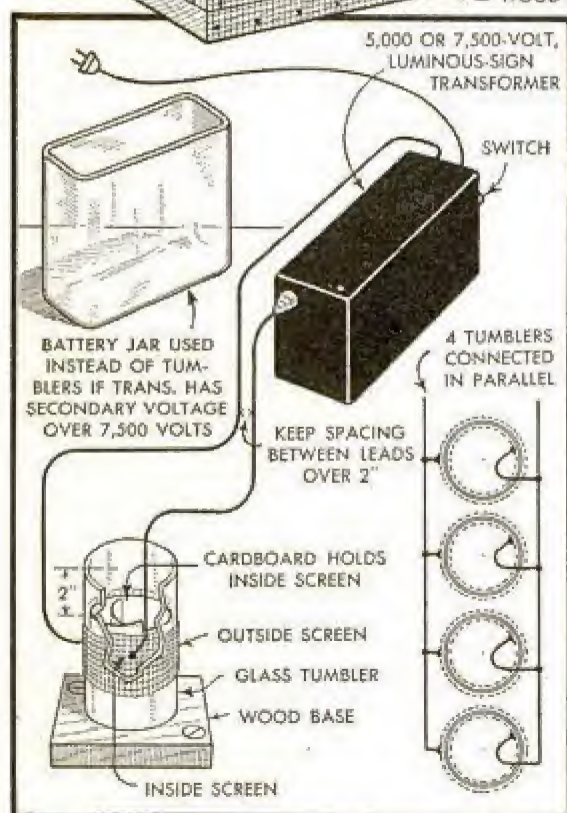
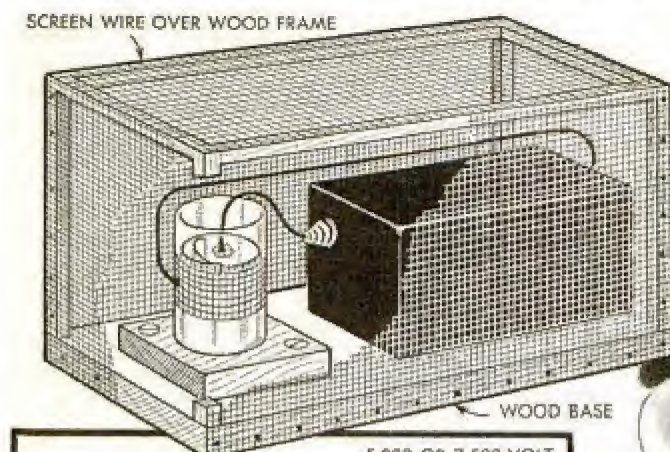
## Hook on Soldering Iron Shank Aids in Opening Metal Seams

When a soldered seam on metal roofing or other sheet-metal work is to be opened for removal or repair, it is customary to employ an old chisel, file or similar tool to hold the seam apart temporarily until the melted solder has cooled. To do this without the use of an extra tool, one tinsmith uses a soldering iron having a stout hook welded to its shank. The hook is inserted under the upper sheet as the seam is loosened, after which it may be moved along to separate the seam as the work progresses.





# Simple Ozone Generator Purifies Air in Home



the transformer produces, to arc through the air between closely spaced wires or electrodes, the lead wires must be kept at least 2 in. apart, and the screen wire sleeves must be located at least 2 in. from the top of the tumbler. The outside sleeve is held on the glass by friction of a close fit on the slightly tapered sides of the glass, and the inside sleeve is kept in place by a rolled piece of cardboard. For an ozonator of greater capacity, four glass tumblers wired in parallel can be used as indicated in the lower right-hand detail. If an ozonator to take care of several rooms is desired, larger containers, such as glass battery jars, can be substituted for the tumblers. A transformer having an output greater than 7,500 volts is needed to operate the larger ozonator. A wire-screen enclosure, the top of which can be opened, prevents any danger of receiving shocks.—J. F. Weber, Mauston, Wis.

This inexpensive ozonator will quickly freshen the air in a room or destroy unpleasant odors. Ozone, which is produced by the generator, is a form of oxygen that is unusually active. The odor of ozone often is noticeable after a thunder storm when lightning produces it from oxygen in the air. In its simplest form, which is adequate to purify the air in an average room, the ozonator consists of a luminous-sign transformer of 5,000 to 7,500 volts having the secondary or output side of the transformer wired to a couple of screen-wire sleeves on a glass tumbler, which serves as an insulator between them. Because of the tendency of high-tension current, which

## Adhesive Labels Typed Easily When Stuck to Waxed Paper

If short lengths of white adhesive tape are stuck to sheets of waxed paper, they can be run through the typewriter and typed for use as labels. They are easily removed from the waxed paper and are useful in labeling drawers, filing boxes, sewing cabinets, jars, etc.





*"Chopping" bar stock*

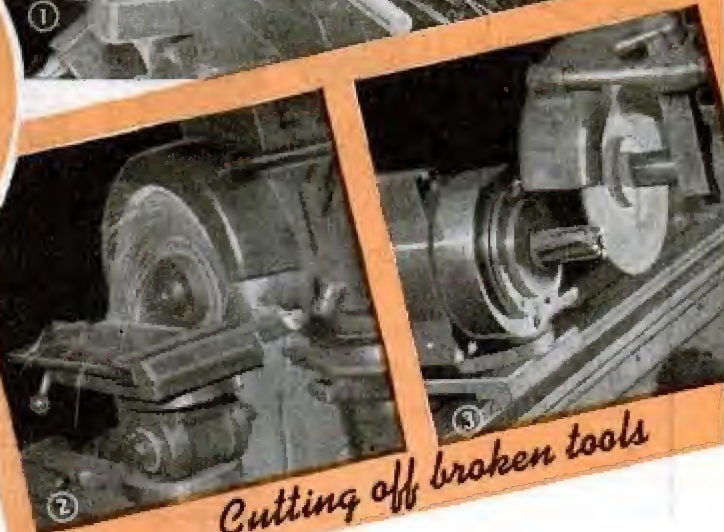
## How to Use ABRASIVE CUT-OFF WHEELS

Running at surface speeds of 2 to 3 miles per minute, abrasive wheels cut materials of any hardness

*By H. J. Chamberland*

ALTHOUGH about seventy-five percent of all metals are cut with either power hack saws or bandsaws, the most rapid method known is abrasive cutting. Originally, cut-off wheels were used to remove, previous to salvaging, broken sections of drills, end mills, turning or forming tools, as shown in Figs. 2 to 4 inclusive, or any other hardened tools that could not be cut with a saw. Now, 16 and 18-in. abrasive wheels are used regularly for cut-off work in quantity production on both ferrous and non-ferrous metals, and also for non-metals such as glass, plastics and ceramics.

**Abrasives and bonds:** Cut-off wheels are very thin grinding wheels and are made in the same way, being built up of abrasive grains bonded with shellac, rubber or synthetic resin. Grains of aluminum oxide are used for cutting most metals and grains of silicon carbide for cutting non-metals. A shellac-bonded wheel is soft and free-cutting and is used generally for cutting hardened steels as it generates a minimum amount of heat. Diameters used are 6 to 10 in., and widths of  $\frac{1}{16}$  to  $\frac{1}{8}$  in., which vary in accordance with the diameter. This type of wheel should operate at 5,500 to



*Cutting off broken tools*



6,000 surface feet per minute (s.f.p.m.). Rubber and resin-bonded wheels are real production tools. The rubber bond makes it possible to produce cut-off wheels as thin as .005 in., which are used to slit gold and iridium pen nibs and for jewelry work. Both rubber and resin-bonded wheels are made in diameters of 16 or 18 in., and are  $\frac{1}{8}$  in. thick. Rubber-bonded wheels cut exceptionally well with a coolant at speeds of 7,500 to 10,000 s.f.p.m. With resin-bonded wheels it has been possible to increase speeds of cut-off wheels to 16,000 s.f.p.m., which results in a marked decrease in cutting time and an increase in wheel life. When employing such high speeds in abrasive cutting, maximum rigidity in all parts of the machine is absolutely necessary in order to eliminate every trace of vibration.

**Wheel selection:** Satisfactory results in abrasive cutting depend mostly on select-



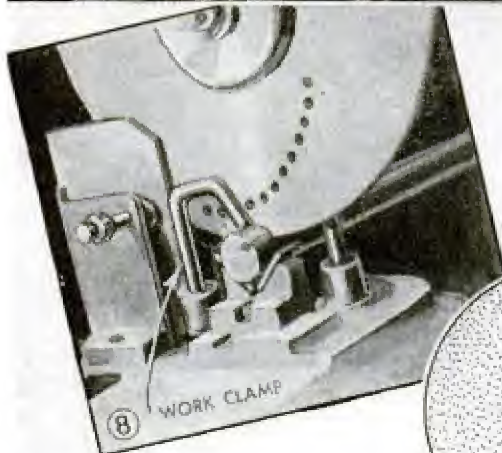
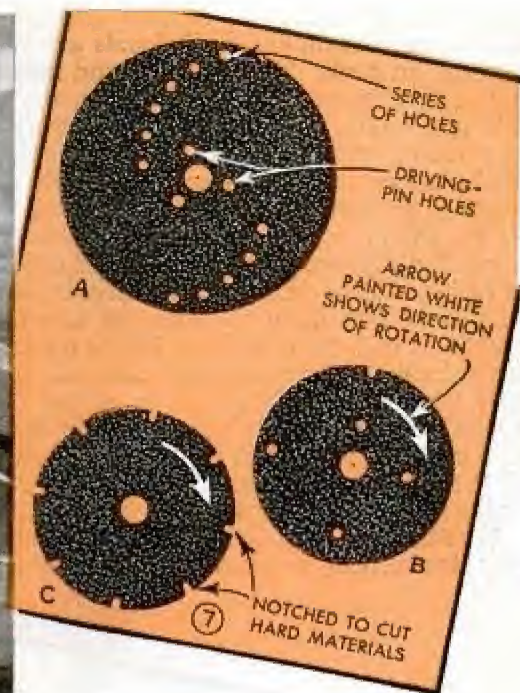
Photos by courtesy of Norton Co.

same direction in case it is removed from and later replaced on the spindle. The reason for this is that when operating at high speeds a cut-off wheel sets up excessive stresses, which should not be reversed as this would shorten the life of the wheel considerably. There are, of course, many wheels that are not provided with such holes, but if desired, any  $\frac{1}{8}$ -in. abrasive wheel can be drilled as in detail B of Fig. 7. The drilling should be done by placing the wheel on a surface as flat as a drawing board. A wheel notched as shown in detail C works very well for cutting hard materi-



ing the correct wheel. In this, the operator must be guided by the type of cut desired and whether there is any objection to discoloration or burr. Also, he must base the selection on the kind of material and whether it is to be cut dry or wet, as well as the type of machine to be used and its speed. Detail A of Fig. 7 shows the design of a typical cut-off wheel. In the early days of abrasive cutting a number of wheels varying in grain size and degree of hardness were required to suit all cut-off purposes. However, this type of wheel simplifies matters as it is provided with a series of holes which automatically provide a lasting open spot on the periphery which causes the grains to break more uniformly as the wheel wears down. Also, there are three driving-pin holes which are spaced so that the wheel must always rotate in the





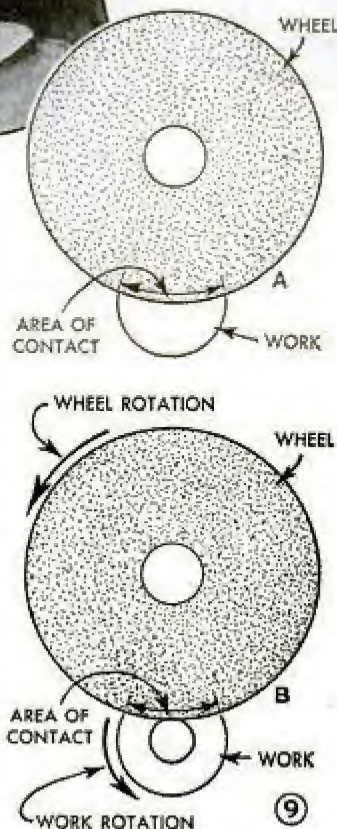
rificing time. A fine-grain wheel will produce a lighter burr but will wear faster than a coarse-grain wheel.

**Wheel wear and feed:** If the grains are to "bite" or remove metal in the form of chips, a certain amount of pressure is necessary. With a light pressure the abrasive grains rub rather than cut, which results in heating and subsequently the bond softens so that the wheel wears down without effectively cutting to its full capacity. The operator alone can determine the correct amount of pressure to use, being guided by the nature of the material and whether or not the cutting is done wet or dry.

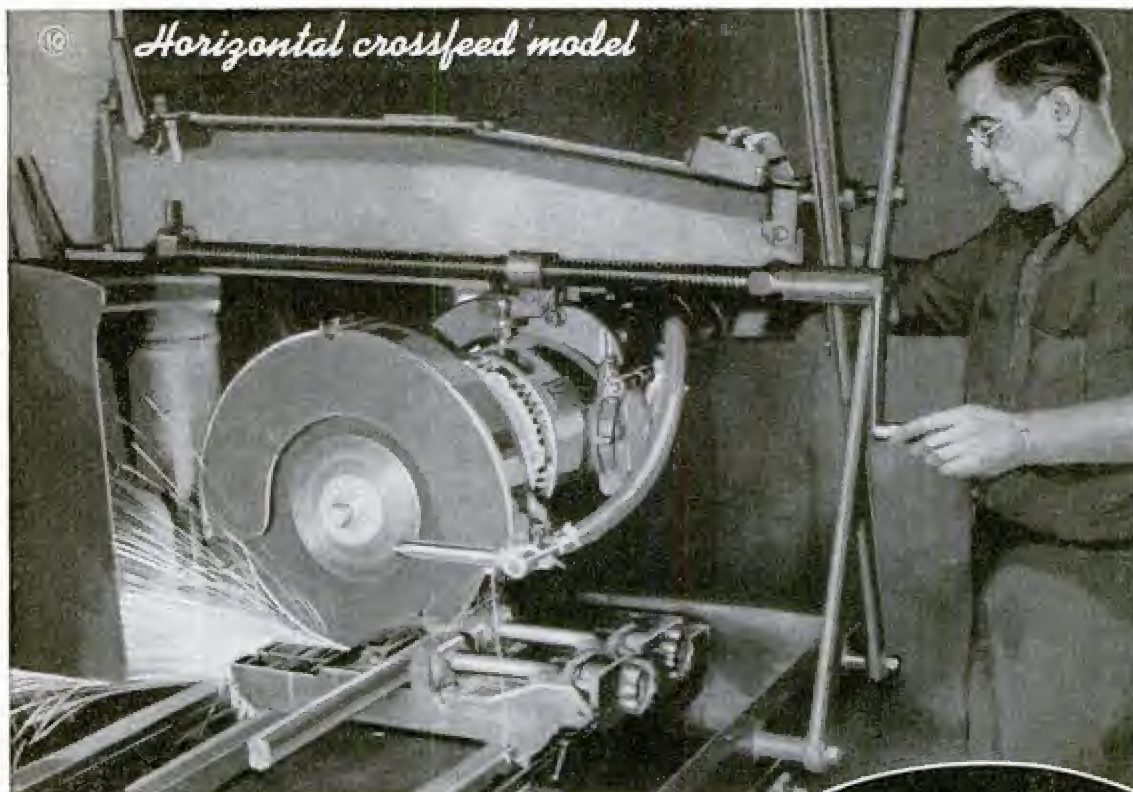
**Peripheral speed:** With dry abrasive cutting, the peripheral speed of an abrasive wheel is highly important. A wheel operating at 15,000 s.f.p.m. will cut twice as many pieces as it will when operated at 9,000 s.f.p.m. The main reason is that at high speed the metal being actually removed is heated to near the melting point and is thus easily removed with very little wheel wear. At lower speeds, the abrasive grains cut the metal in the kerf, and the grains of the wheel are more easily pulled from the bond by the increased load. If a 16-in. wheel is used on a ma-

als. Notching can be done repeatedly and readily as the wheels wear down, with another cut-off wheel. In Fig. 8 the wheel guard has been removed to show one method of clamping the work, in this case by foot pressure. Another similar method works hydraulically.

Discoloration of work when dry-cutting indicates that too much heat is being generated; the resulting skin-hard surface may affect machineability of the material if this is to follow. Discoloration can be avoided either by wet-cutting or using a different type of wheel. Burring cannot be eliminated entirely but can be minimized by sac-



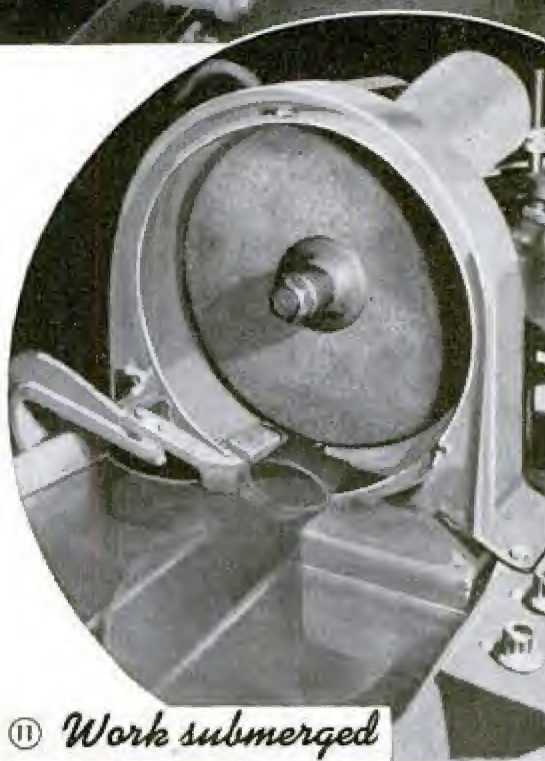




chine intended for a related wheel surface speed, the wheel, when worn down to 12 or 13 in., must necessarily be set up in another machine of higher speed in order to maintain the same surface speed.

Wet abrasive cutting presents a different condition. In this case the surface speed must be limited to about 8,000 s.f.p.m. because it is the maximum at which the coolant can be held on the wheel sufficiently to avoid generating heat. Furthermore, a lowering in speed when cutting wet is not nearly so detrimental to wheel life as when cutting dry. When using a coolant freely, wheel efficiency is only about 15 percent less at 4,000 than it is at 8,000 s.f.p.m.

**Types of machines:** Equipment shown in Figs. 1, 5 and 6 is known as the "chopping" type and is in general use in most metal-working plants. If the equipment is not up to par, a speed of 10,000 s.f.p.m. should not be exceeded. With "chopping" machines, the wheel is fed to the work vertically. When cutting through solid stock as shown in detail A of Fig. 9, the contact area is greatest at the center or axis of the work. The operator should start with the maximum pressure and cut it down gradually by one-third at the center, then gradually increase the pressure again after passing the center. When cutting tubular stock as shown in Fig. 6, a constant pressure can be maintained. When the wall thickness is substantial, maximum pressure should be applied only when the wheel has penetrat-

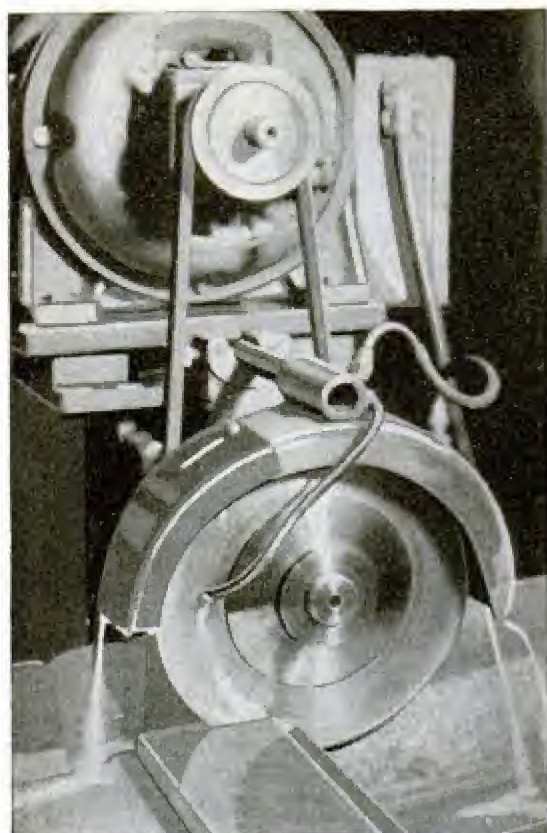


⑪ *Work submerged*

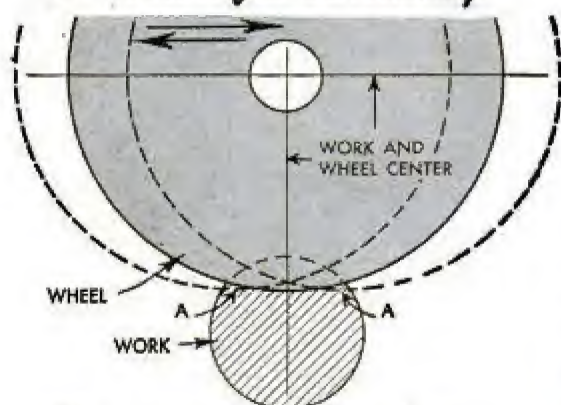
⑫ **CUTTING TIME ON NON-FERROUS METALS**

Material	Size in inches	Time in seconds
Navy bronze	3½ round	30
Manganese bronze	3½ square	120
Monel metal	2½ round	30
Stainless steel	1¼ round	8
Brass	1½ round	15
Aluminum	2 round	12
Brass	2½ X 1	15





⑬ *Wheel fed vertically*



⑭ OSCILLATING MOVEMENT OF WHEEL FOR SOLID STOCK OVER 2½" DIA.

ed the wall. So important is area of contact to wheel life that some shops have provisions to revolve the work slowly while cutting proceeds as shown in detail B of Fig. 9. In this case the area of contact is cut down to the minimum or controlled solely by the amount of down-feed to each revolution of the work. Fig. 11 shows a chopping machine of the submerged type for cutting thin-wall copper or brass tubing and sensitive steels where burr and heat must be avoided. The work and the lower part of the wheel are submerged in a coolant. For this use, rubber-bonded wheels 12 by ¾ in., operated at 6,000 to

7,000 s.f.p.m. are recommended. Submerged cutting provides the smoothest cuts possible.

The cut-off machine shown in Fig. 10 is of the horizontal crossfeed type, has an automatic feed and cuts with a single pass. Maximum sizes cut are 2-in. solids and 3½-in. tubes or pipes. Fig. 13 shows a similar machine but the table has a longitudinal travel and the wheel is fed vertically. Cutting is done progressively and the amount of feed or depth of cut per pass depends on the material. This procedure applies chiefly to cutting plate glass, steel slabs, plastics, refractory bricks, quartz crystals and similar materials. Rubber or resin-bonded wheels having silicon-carbide grains are used for this kind of work. The wheel speeds range from 7,000 to 8,000 s.f.p.m., and a coolant must be used freely.

Fig. 12 gives the cutting time in seconds on non-ferrous metals, assuming a correct wheel has been selected and is run at the proper velocity.

**Oscillating cuts:** Solid stock exceeding a diameter of 2½ in. cannot be cut economically by any method previously described, as the wheel cost would be prohibitive owing to the large contact area of wheel and work. The cutting of large-diameter solid stock is made possible only by oscillating wheel movement in connection with downward feed as shown in Fig. 14. As the wheel oscillates through the cut, the area of contact is reduced to a minimum and thus provides means of cutting diameters otherwise impossible. Note also sections A-A, which represent clearance when the wheel axis is in line with that of the work during the cutting. This method requires but one-quarter the pressure required for non-oscillating movement. Fig. 15 gives comparative figures of oscillating and non-oscillating cuts. The material in this case

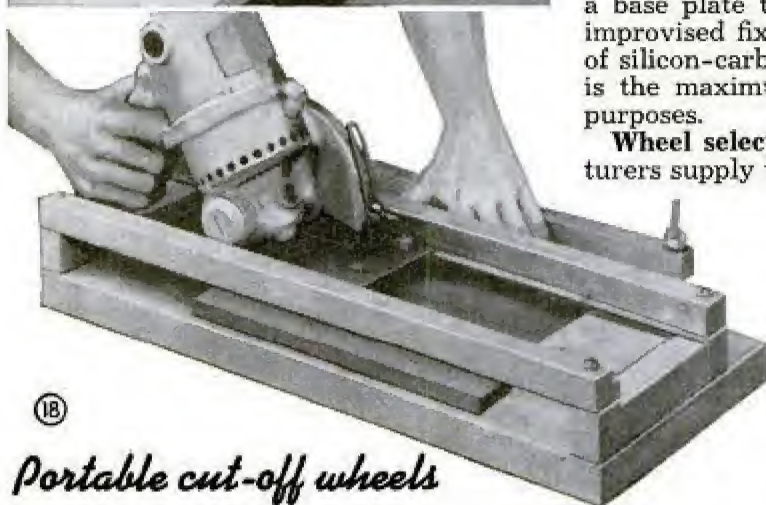
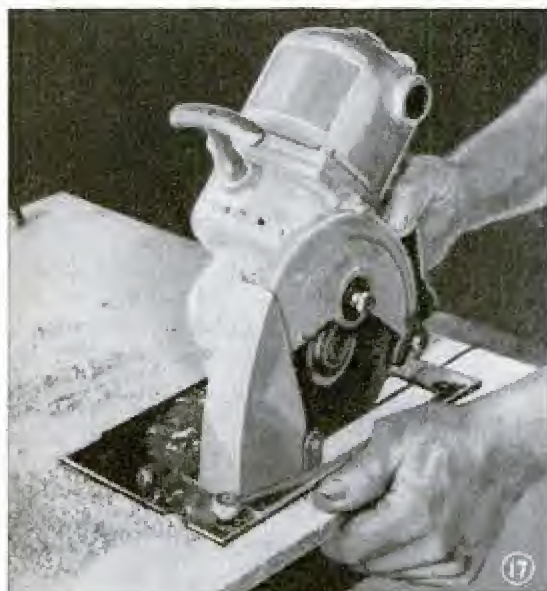
⑮ CUTTING LOW-CARBON STEEL

Dia. in inches	Time in seconds	Number of cuts
(Using 16 by ¾-in. wheel; non-oscillating cut)		
½	2	1150
¾	3½	500
1	5	400
1¼	8	200
1½	12	100
1¾	15	65
2	18	50
(Using 18 by ¾-in. wheel; oscillating cut)		
1	10	610
1½	25	300
2	50	165
2½	90	85
3	150	50
4	210	35
5	300	20
6	360	10



is low-carbon steel which is, surprisingly, harder to cut than high-carbon steel.

**Improvised and portable machines:** If a pedestal type grinder is in good condition, it can be made into a cut-off machine as in Fig. 16 by the addition of an infeed work-holding member. Diameter of the wheel should not exceed 10 in. Abrasive cut-off wheels from 6 to 8 in. in diameter are often used on circular saws, especially in metal pattern shops. In any improvised adaptations, it is imperative that the work be securely held so that parallelism of cut can be held within .002 in., which can save 10 lbs. of material on 100 cuts.



*Portable cut-off wheels*



*Grinder as cut-off machine*

Typical applications for portable cut-off units are shown in Figs. 17 and 18. In Fig. 17 the material being cut is Transite and in Fig. 18 the material is tile. The unit shown in Fig. 17 is guided by means of a base plate traveling in the track of an improvised fixture. Both wheels used are of silicon-carbide grains, resin-bond; 8 in. is the maximum diameter used for such purposes.

**Wheel selection and coolant:** Manufacturers supply tables giving general recommendations for selecting cut-off wheels. These tables will save considerable time and wheel cost usually wasted by the cut-and-try procedure. While a solution of water and mild soda makes a good coolant, there are better coolants on the market to speed up cutting and extend wheel life.

## How to Avoid Common Troubles With Belts Used on Flanged Pulleys

If a flanged pulley is not aligned correctly, or if dirt or belt dressing accumulates at the bottom of the groove until it is higher than the pulley crown, the belt moves to the higher side and tries to climb the flange. This results in the belt stretching

and becoming worn and frayed. To avoid this trouble, be sure that the pulley is amply wide so that the edges of the belt do not touch the flanges when alignment is correct, and also keep the surfaces of the belt and pulley face clean.



## Old Pick Is Converted Into Tool For Removing Worn Flooring



We have used this tool for many years to take up old flooring, either over a sub-floor or over joists. Made by forging an old pick to the shape indicated, or other shape that is most convenient for the user, the tool makes it unnecessary to stoop or get down on one's knees. The ends of the tool should be sharp and hard so that it will withstand contact with nails.

—Edward Schumacher, Mankato, Minn.

## Adjustable Hook for Shop Lamp



Attached to the steel hook of an extension shop lamp, a length of lead wire or wire solder permits raising or lowering the lamp a few inches as desired. Also, the wire permits extending the hook to fasten it in hard-to-reach places. The wire is run through the eye on the lamp

shield and is held at the desired adjustment by twisting a loop in it as indicated.

## Keeping Worn Boring Mill in Use

If a boring mill has become so badly worn that it bores a tapered or out-of-round hole, it still can be pressed into service in an emergency as follows: First, bore the work in the machine in the regular way, but make the hole .015 to .020 undersize. Then set the work up in a heavy-duty drill press and ream the hole to size, using an

adjustable reamer of the inserted-blade type. If the work is in production, much time can be saved by providing the drill-press table with suitable fixtures to hold the work so that the hole is centered under the drill-press spindle.

—Orville E. Hyler, Peoria, Ill.

## Life of Paper Stencils Increased By Covering of Cloth

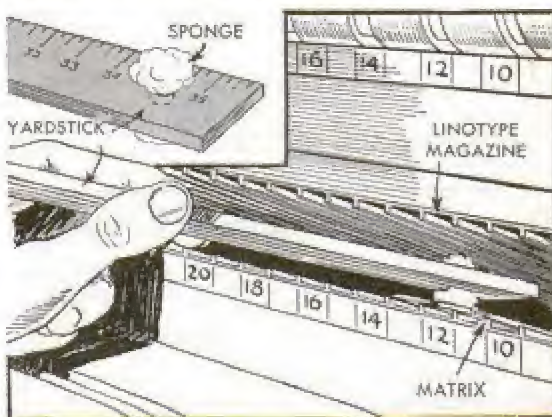
Painters and decorators who use paper stencils in their work, often are inconvenienced by having fine detail parts crack and break out under repeated use. To avoid this, glue strips of mosquito netting over the face of the stencils. The same treatment may be employed for lettering stencils used by shipping clerks.



Waterproof glue or shellac may be used for attaching the cloth, but the adhesive should be applied to the stencil only, and the cloth should be placed carefully on the stencil so that glue does not clog the cloth meshes over the stencil openings, which would prevent passage of the stencil paint through the meshes to the work underneath.

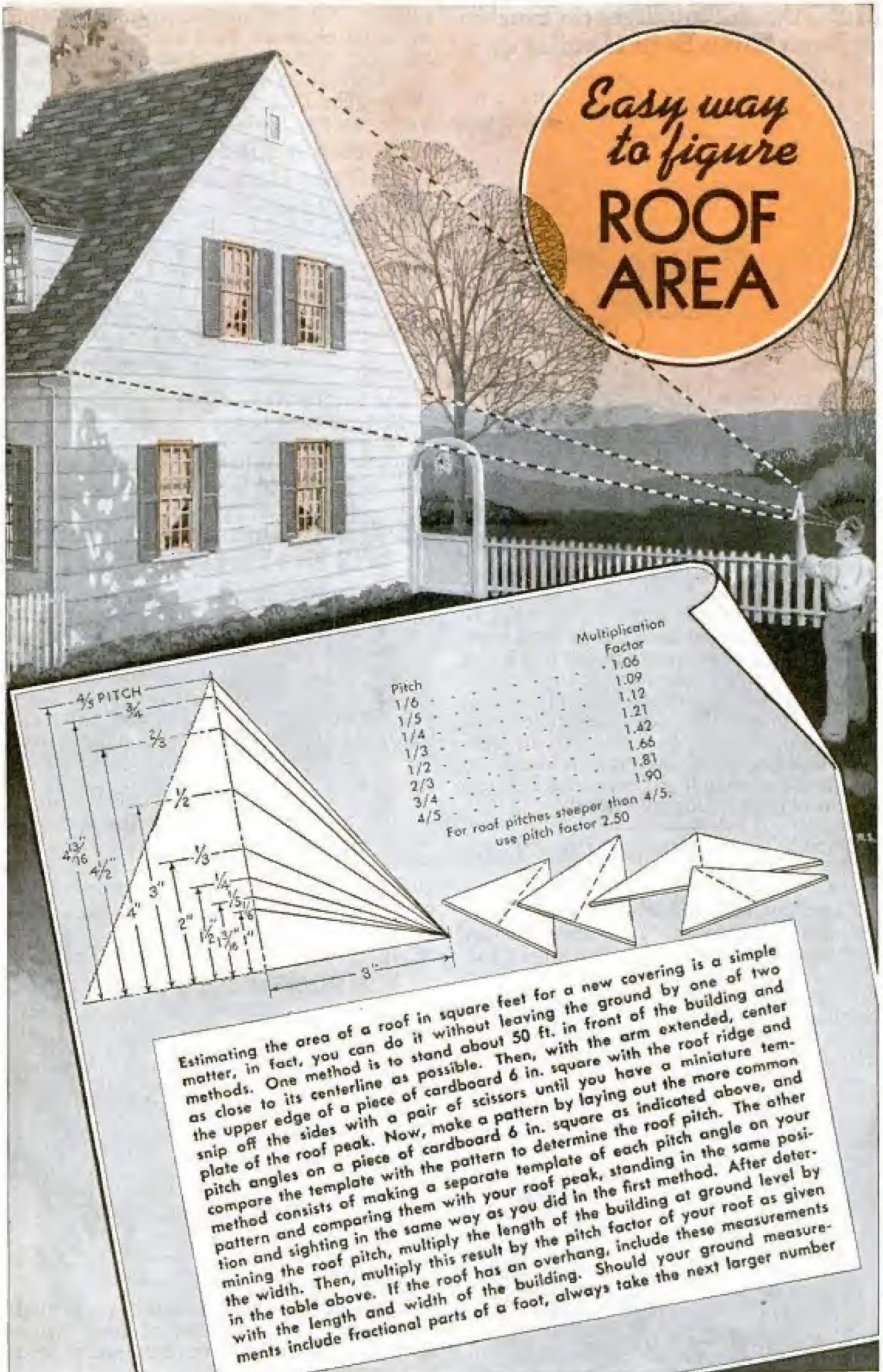
## Yardstick Fishes Loose Matrix From Linotype Magazine

The common practice of using a wire hook to fish a loose matrix from the channel of a linotype magazine may result in scratches which will eventually cause considerable trouble by damaging the channels. To avoid this, one printer employs a yardstick, in the end hole of which is fitted a small piece of sponge. With this stick, he can remove the mats quickly without any danger of damaging the magazine.





## Easy way to figure ROOF AREA



**Pitch**

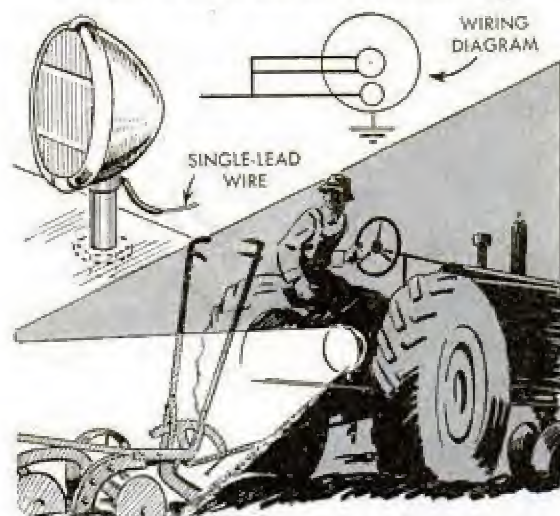
Pitch	Multiplication Factor
1/6	1.06
1/5	1.09
1/4	1.12
1/3	1.21
1/2	1.42
2/3	1.66
3/4	1.81
4/5	1.90

For roof pitches steeper than 4/5, use pitch factor 2.50

Estimating the area of a roof in square feet for a new covering is a simple matter, in fact, you can do it without leaving the ground by one of two methods. One method is to stand about 50 ft. in front of the building and as close to its centerline as possible. Then, with the arm extended, center the upper edge of a piece of cardboard 6 in. square with the roof ridge and snip off the sides with a pair of scissors until you have a miniature template of the roof peak. Now, make a pattern by laying out the more common pitch angles on a piece of cardboard 6 in. square as indicated above, and compare the template with the pattern to determine the roof pitch. The other method consists of making a separate template of each pitch angle on your pattern and comparing them with your roof peak, standing in the same position and sighting in the same way as you did in the first method. After determining the roof pitch, multiply the length of the building at ground level by the width. Then, multiply this result by the pitch factor of your roof as given in the table above. If the roof has an overhang, include these measurements with the length and width of the building. Should your ground measurements include fractional parts of a foot, always take the next larger number



## Multi-Beam Floodlight on Tractor From Twin-Bulb Headlamp



Desiring a bright flood light for use on his tractor, a farmer made one from an old auto headlight of the type that contains a parking bulb and a twin-beam headlight bulb. To do this, the parking bulb was replaced with one of greater candlepower, after which the three wires from the headlight were soldered to a single lead wire so that the three elements in the two bulbs would be turned on simultaneously. As most car headlights are grounded through the lamp to complete the electrical circuit, it will be necessary to run a second wire from the tractor battery and solder it to the lamp housing if your tractor lighting system is not already grounded.

## Oil Film on Luminous-Sign Tube Prevents Formation of Ice

When long runs of luminous-sign tubing are exposed to the weather, such as when used around the eaves of buildings as at filling stations, ice may form on the tubing during cold weather and add enough weight to break it. To avoid this, rub the



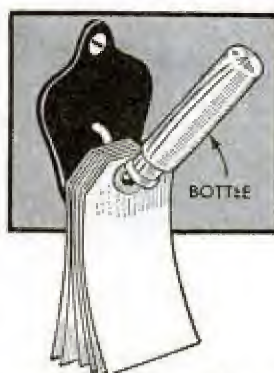
tubing with cloth dipped in light oil such as No. 20 motor oil. This will prevent water freezing on the tubing, and will not affect its illuminating qualities to any great extent.—Fred Day, Auburn, Me.

## Plumber's Kit Easily Balanced By Strap Handle for Carrying

The varied contents of a plumber's tool kit make it practically impossible to balance it for easy carrying with the conventional handle. One plumber simplified this by riveting a stout strap to the cover as indicated. With this handle, the hand may be shifted to balance the load.



## Shipping Tags Held by Bottle Will Not Blow Off Spindle

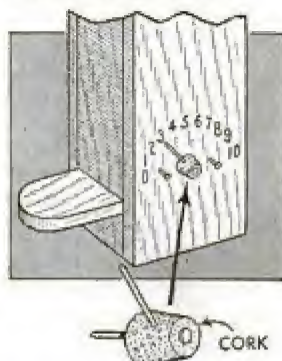


easily so that the tags can be removed or new ones added without difficulty.

An empty bottle slipped over the end of a paper spindle located on an outdoor loading platform will keep shipping tags on the spindle from being blown off by the wind. When tags are needed, they are at hand, and the bottle is slipped on and off

## Counter on Grain Spout Tallies Measures of Feed Removed

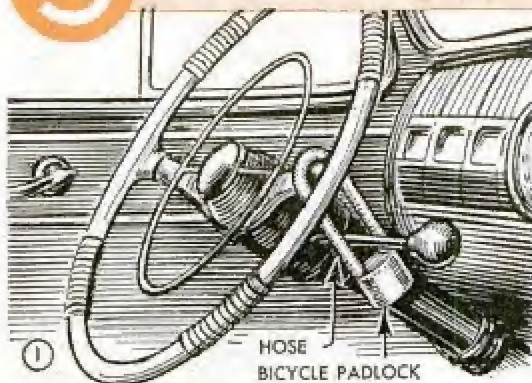
To tally measures of feed taken from a spout in his granary, one farmer nailed a large cork onto the side of the spout and forced another nail through it at right angles to serve as a pointer. The required numerals were then marked on the spout so that the pointer could be turned to indicate the measures of feed withdrawn. Nails at the sides of the cork serve as stops for the pointer.





5

## HANDY AUTO HINTS



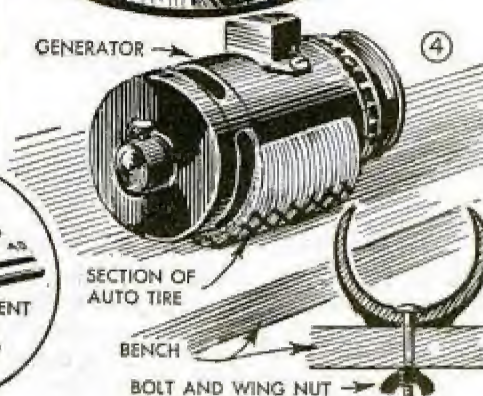
1: In addition to the regular locks on your car, a bicycle padlock around the steering wheel and gear-shift lever will provide further protection against possible theft if the doors are forced

2: Painted with black-and-white stripes and hung at the back of a car while making repairs on the road, a piece of canvas or oilcloth provides a warning signal that attracts attention

3: Scuffing of fenders on the sides of a narrow entrance doorway can be avoided by providing buffers of large rope as shown. The ropes are tied into holes drilled through the door posts

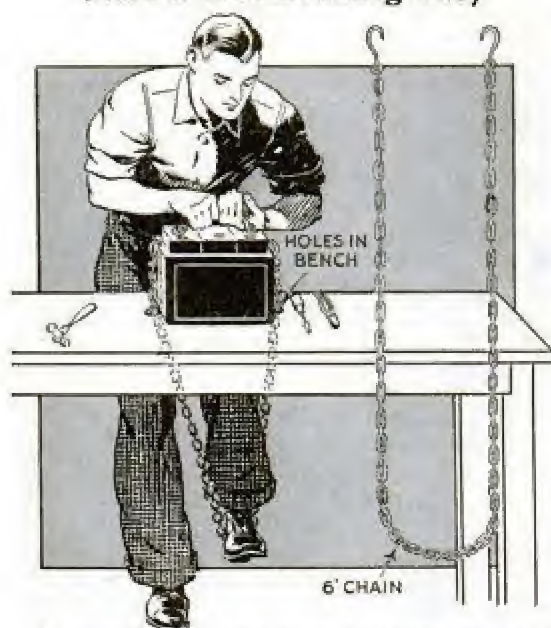
4: A flexible cradle for holding a generator on a bench while testing or repairing it can be made by pivoting a section of heavy auto tire to the bench top, using a bolt and a wing nut

5: A bobby pin bent and spread as shown to correspond with the length of a scale on a road map provides a convenient "rule" with a handle to use when checking mileage distances on map



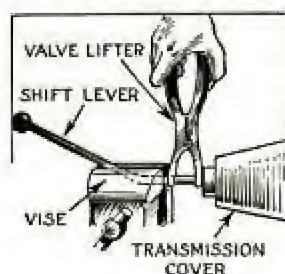


## Hold-Down for Battery Case Makes Dismantling Easy



A garageman devised this simple method of holding a storage battery firmly on a bench while lifting out the cells. A 6-ft. length of old tow chain with small hooks on the ends is inserted through holes in the bench, and the battery is set between the holes. Then, the compound around the cells is softened with a torch and the hooks, which have sharp points, are placed on the ends of the case. Now, by pressing down on the lower part of the chain with his foot, the battery is held firmly against the bench to lift out the cells.

## Gear-Shift Lever Replaced Easily With the Aid of Valve Lifter



The usually difficult job of compressing the spring to replace a gear-shift lever is no problem if a valve lifter is used as shown. Just clamp the lever in a vise, then with one side of the lifter

against the jaws and the other against the spring, squeeze the handles to force the spring in place. Replacing the spring retainer completes the job.

## Glare of Cowl Ventilator Avoided

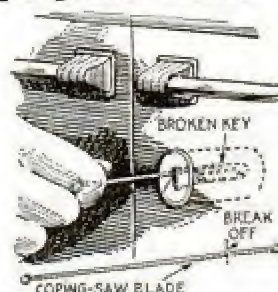
If, when driving with your cowl ventilator open, it sometimes reflects a blinding glare in your eyes, give its surface a non-reflecting finish. To do this, first, clean the surface to remove all wax or grease. Then

thin some orange shellac with alcohol and add a powdered pigment of a color to match the car finish, and apply it to the cowl. If at any time it is desired to remove the coating, use denatured alcohol. In most cases, application and removal of the coating will not damage the lacquer or enamel finish underneath.

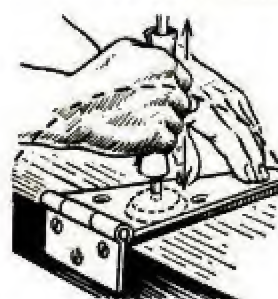
## Broken Car Key Removed Easily With Fine Coping-Saw Blade

After twisting off a key in an auto lock, I removed it in a jiffy by using a small wire-type blade from a coping saw. The end of the blade was broken off, after which it was inserted into the lock slot on top of the key with the teeth pointing outward. Then, by pressing down with the blade and pulling forward, the broken portion of the key was removed.

—A. H. Waychoff, Phoenix, Ariz.



## "Vise" From Hinge Holds Valves While Cleaning Stems



As the stems of auto valves should be sanded with a lengthwise motion when cleaning them, one mechanic made a simple vise to hold the valve in a vertical position while carrying on this operation.

The vise was nothing more than a hinge of the type shown, one side of which was screwed to the edge of the workbench so that the other side could be folded down on top of the table to hold the valve head firmly with the stem projecting through one of the screw holes.

## Ice Formation in Carburetor Checked by Use of Alcohol

Formation of ice in carburetors during cold weather is made less likely by adding alcohol to the gasoline every time the gas tank is filled, in the proportion of alcohol,  $\frac{1}{2}$  pt., to gasoline, 7 gal. There is no noticeable change in the normal operation of the engine when this mixture is used, and the trick is as effective with tractors and motorcycles as it is with automobiles.

—H. R. Alley, Northbrook, Ill.



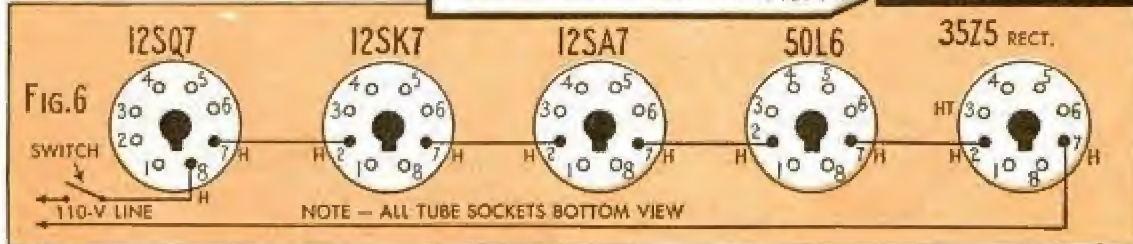
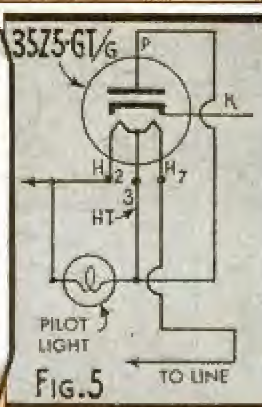
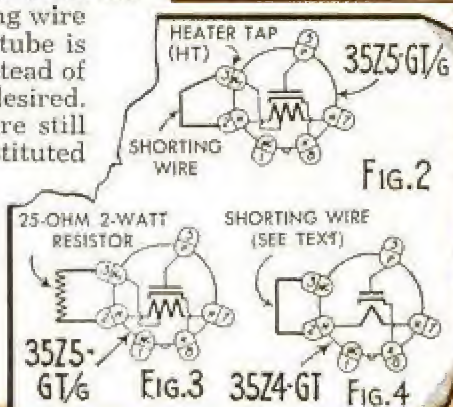
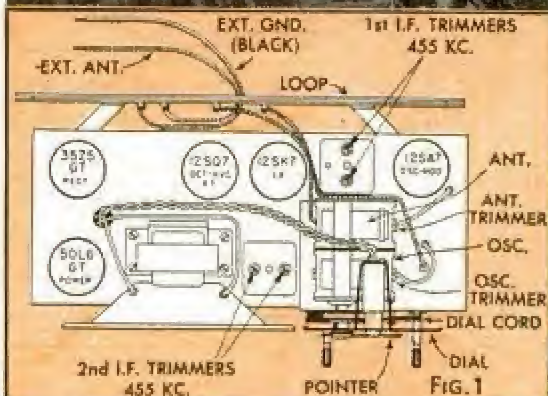


# Radio

## Solving Wartime Home Set Tube Replacement Problems

FOR several good reasons, manufacturers of small modern table-model receivers favored the particular tube lineup shown in Figs. 1 and 6, with the result that replacement tubes of these types are becoming very scarce. Radio training schools and war equipment requirements have, and should have, first call on tubes. More of these, and similar high-filament-voltage tubes will be available for replacement use in civilian sets soon, but in the meantime radio servicemen and set owners can help solve this problem temporarily by checking filter condensers for excessive leakage and making a few simple adjustments or substitutions that will restore many of these receivers to useful service.

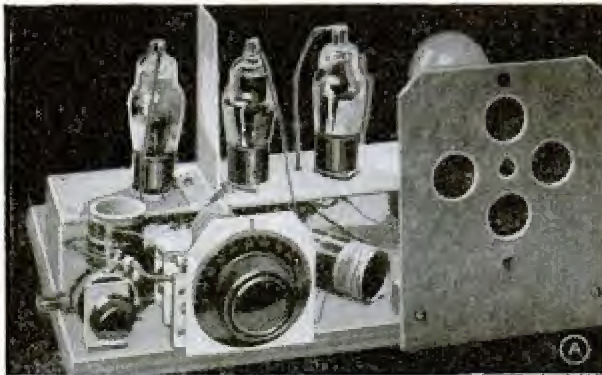
The 35Z5 tube is the chief troublemaker and, as most servicemen know, it has a tapped filament. All of the filament is connected between pin No. 2 and pin No. 7, and the tapped portion is connected between pin No. 2 and pin No. 3, as shown in Figs. 2 and 3. This tapped section is for the pilot lamp and it frequently opens up, putting the entire set out of business. Continuity can be restored with a shorting wire, as in Fig. 2, soldered to the ends of the tube pins on the under side of the set when the tube is in its socket. The shorting wire must be removed when a new tube is installed. Use resistor Fig. 3 instead of the jumper wire if pilot light is desired. In some localities 35Z4 tubes are still plentiful; this tube can be substituted for the 35Z5 by shorting pins 2 and 3 as in Fig. 4, but the pilot light is shunted out. Fig. 5 shows detailed 35Z5 circuit connections. Further practical suggestions for wartime tube substitutions will appear next month.





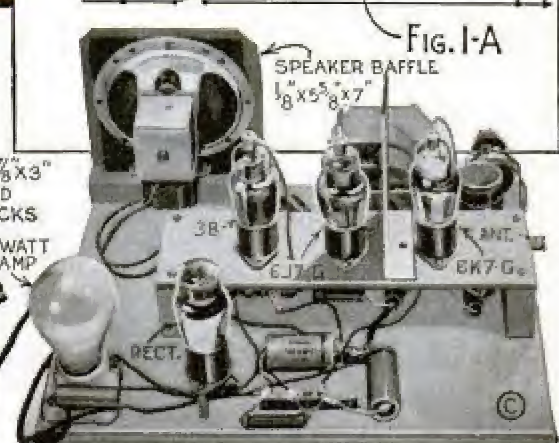
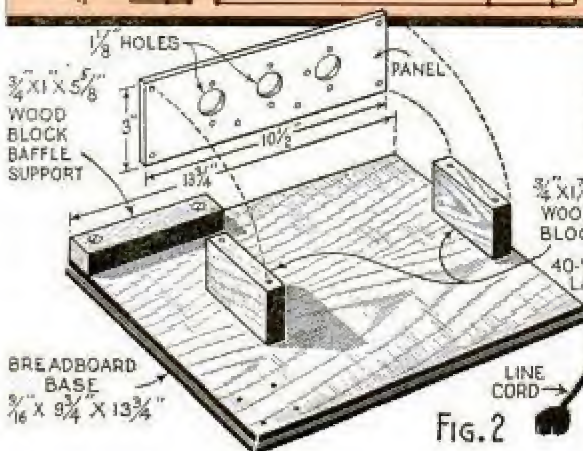
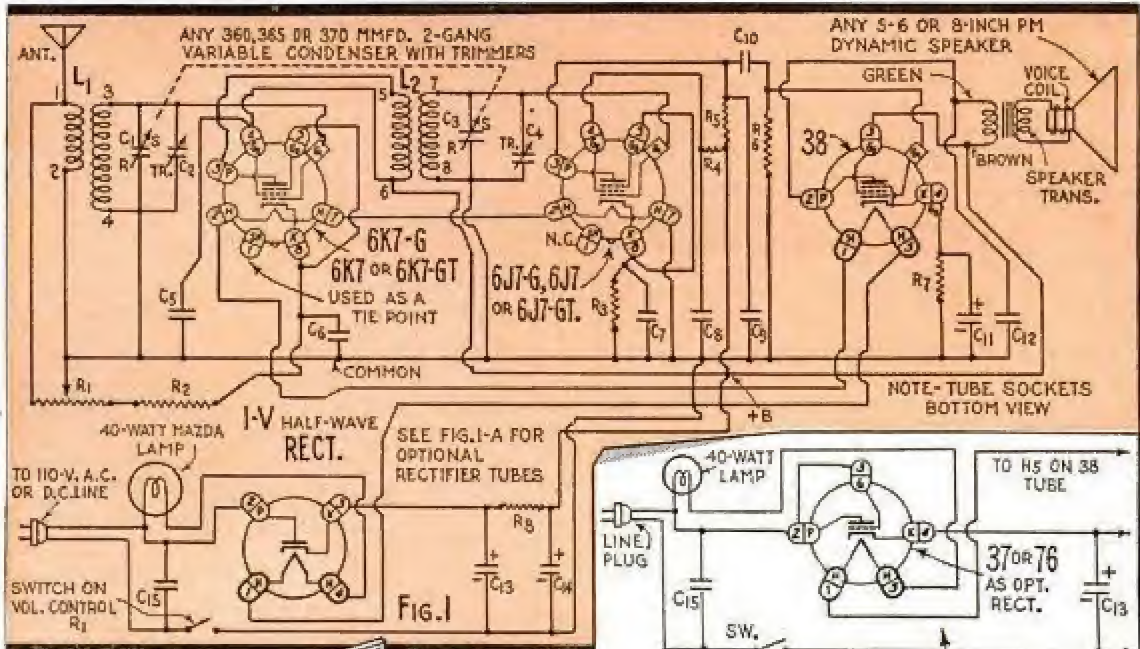
# 1944 "LITTLE GIANT"

By Stanley A. Johnson



ALTHOUGH stripped of peacetime frills and built entirely from parts and tubes salvaged from old radios, this March, 1944, "Little Giant" tuned-radio-frequency 4-tube is an effective and practical model for a classroom project or the individual student experimenter. Despite its simplicity, the receiver has more than ample volume, sensitivity and selectivity for good broadcast reception. Like previous models of this popular set it teaches the student builder to be self-reliant in using available non-critical materials for practical construction purposes, and supplements classroom instruction.

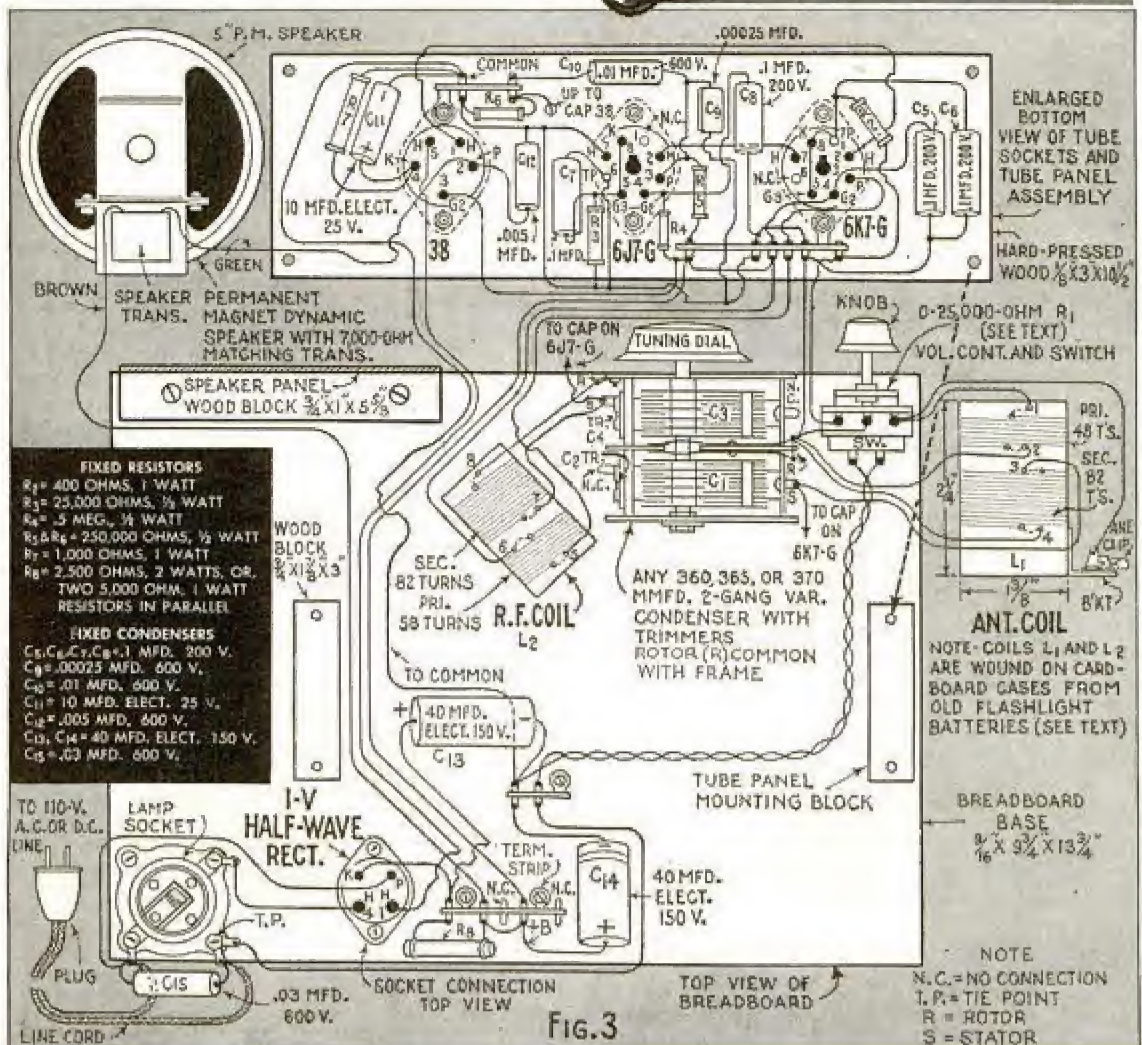
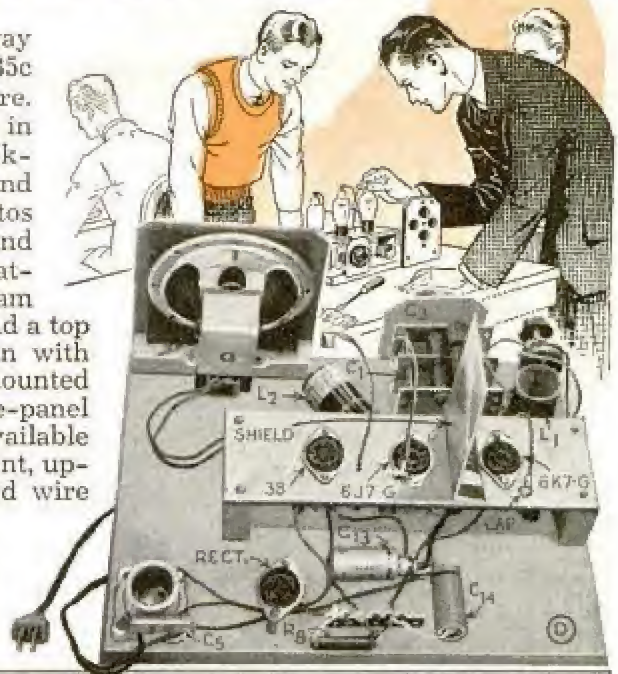
Employing an easy-to-follow breadboard layout, the set uses four common older-type tubes for which numerous substitutions are possible.





# BUILT from ODDS and ENDS

An ordinary 40-watt lamp does away with the usual linecord resistor, and the 35c breadboard comes from the "dime" store. The schematic circuit diagram appears in Fig. 1, and an optional rectifier tube hook-up is shown in Fig. 1-A. All baseboard and layout details are given in Fig. 2 and photos A, C and D. The coils are hand wound and the leads prepared for soldering as indicated in photo B, and pictorial wiring diagram Fig. 3. All parts values are identified, and a top view of the baseboard wiring is shown with connecting leads running to the parts mounted on the underside of the elevated tube-panel strip. Detailed material list R-322 is available from Popular Mechanics radio department, upon receipt of postage. No. 32 enameled wire for the coils was obtained from a burned-out filter choke; these close-wound primary and secondary coils are spaced  $\frac{1}{8}$  in. apart and all wound clockwise. No external ground is used.

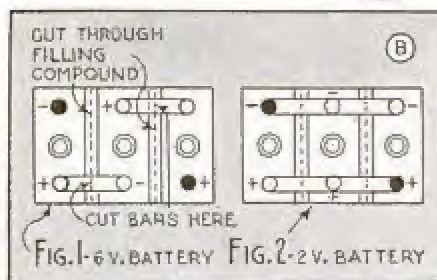




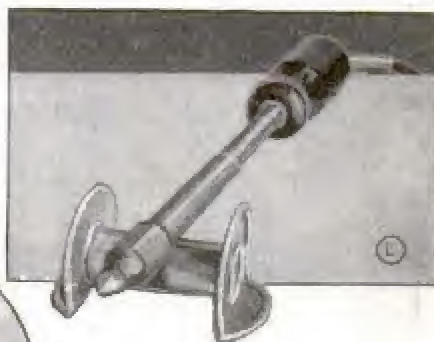
# Practical RADIO HINTS



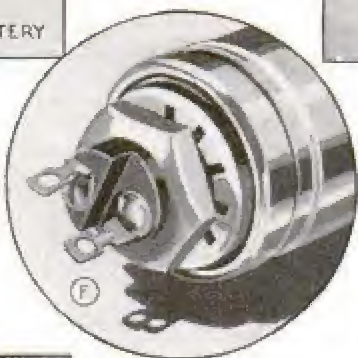
(A) When dismantling old radio units for useful materials, unsolder all fixed resistors and condensers instead of clipping leads which will later be required for servicing receivers or building experimental circuits. Students should save coils, sockets and screws and provide separate compartments for them in their junk boxes



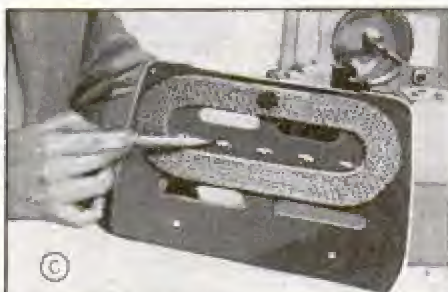
(B) Six-volt auto battery altered for 2-volt tube sets. Cut with hacksaw, then raise and reverse center section for parallel connections as in Fig. 2



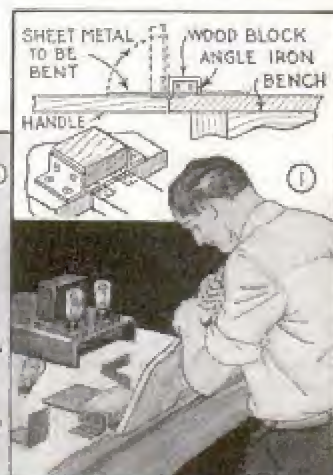
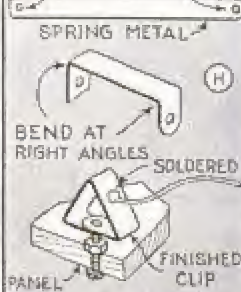
(C) Mounted "spiderweb loop" can be used to replace the antenna coil in many old table-type receivers. Loop connects in place of secondary across gang tuning condenser. (D) Acetate cloth tape wrapped around worn places on telephone or radio headphone cords lengthens useful life of cord



(G) Fig. 1 shows homemade crystal cast in 1/2-in. metal cup. A piece of lead the size of a pea is melted and 1 gram of sulphur is mixed with the lead and then poured into the cup to cool. Circuit connections are made at contacts B and B. (H) Emergency spring clip fits over machine screw terminals. (I) Simple metal-bracket bender for your workbench. Height of wood block depends on thickness of the scrap metal on hand



(E) Emergency soldering-iron stand made from metal spool on which wire solder is supplied. (F) Improved oil-filled inverted screw-type condenser has both terminals insulated from metal can





# Atlas MILLING MACHINE



CONDENSED SPECIFICATIONS			
Table	4 1/2" x 18"	Number of Spindle Speeds	12
Table Travel		Speed Range	61 to 2860 RPM
Longitudinal	6"	Overall	25 1/2" x 32 1/2" x 22"
Vertical	6"	Motor	1/3 HP 1740 RPM

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Sharper shooting . . . closer bombing . . . greater speed — that's our edge on the Nips! And the precision that makes it possible begins on American production lines where less than a thousandth of an inch is a sacred thing to Uncle Sam's crack machinists.

In production plants throughout the country and in the mobile machine shops of our armed forces, Atlas machine tools are helping make and keep our fighting weapons on top. The Bench Milling Machine is one of the Atlas tool room and production favorites that have taken over small parts work to release large machines for larger jobs in plant after plant. This compact, modern tool handles all milling operations with split-hair precision.

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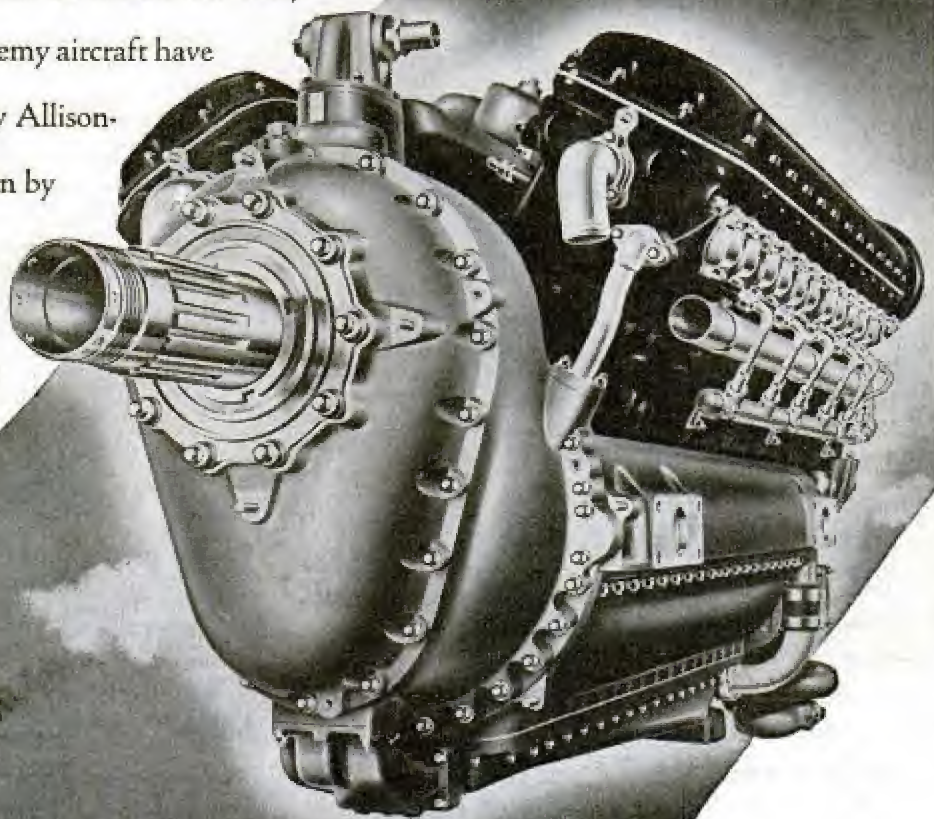
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downs. ★ By that standard the Allison engine rates  
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On all battle fronts,  
the mention of "home"  
brings fond memories of happy motor-  
cycling days to many a lad, just like  
this fighter in a certain Fleet Air Wing.

"I've always owned a motorcycle and I in-  
tend to purchase a new Harley-Davidson  
after the war. Harley-Davidsons sure stand  
up under all strains. They take all the pun-  
ishment the Army gives them, so they're  
good enough for me. They really are tough  
—I can hardly wait to get my new one!"

That's from an actual letter by a rider  
named Al—one of the many thousands  
who are yearning for the fun of endur-  
ance runs, hillclimbs, gypsy tours and  
race meets. And when those "good old  
days" come again, war-proved Harley-  
Davidsons will be better than ever!

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Our Government is asking everyone to conserve tools. That's why many types of tools are sold now by your Hardware Dealer for essential wartime uses only.

But if you cannot get a new hand saw, quite likely you can have your old one reconditioned. If your saw is a Disston—or other quality make—a good, inexpensive sharpening and repair job now will put it in serviceable condition.

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You are serving both your country and yourself when you make the most of your present equipment... See the Disston dealer near you about reconditioning your old saw... Help save new tools for vital war work.

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**HENRY DISSTON & SONS, INC.**  
311 Tacony, Philadelphia 35, Pa., U. S. A.

## More Deadly Than War

(Continued from page 69)

man-hours resulting from shipyard accidents.

A similar contest was instituted by the safety council between the repair depots of the Army Air Forces Service Command. Reports indicate the safety records in these depots are better than the record for the aircraft industry as a whole, though the industry, employing a larger percentage of women than any other, is near the bottom of the list in frequency or severity of accidents. Late figures show that the lumbering, mining, refrigeration, clay products and marine industries are the top five in frequency of mishaps, while the "big five" in severity of accidents are mining, cement, refrigeration, quarrying and construction.

One phase of the safety campaign among war workers which is receiving particular attention from the National Safety Council and industry leaders is the alarming rate of off-the-job accidents. It is realized that production suffers even more from accidents off the job than from those taking place in factories. Figures for 1942—the year when there were 18,500 occupational deaths—show that 26,500 workers died as a result of mishaps when they were not at work, and there were more than 2,000,000 injuries off the job compared with 1,750,000 on the job.

Safety precautions to be followed when workers leave their tasks have become a fixed part of industrial safety programs in an effort to lower the total accident rate as well as to reduce the cost or economic loss which, for all accidents amounted to more than \$5,000,000,000 in 1942, including wage loss, medical expense, overhead costs of insurance, property damage in motor vehicle accidents and fires, and the so-called "indirect" costs of occupational accidents.

## Giving Tools of War the Third Degree

(Continued from page 75)

X-raying 17,000 castings in 24 hours without interrupting other work while the exposures are being made.

X-ray diffraction instruments of advanced design now make it possible to produce and accurately process in quantity quartz crystals or "quartz oscillator plates" which fix the frequency of radio transmitters and receivers used by Army, Navy and Air Forces. Heretofore, the operation was done by hand and eye, and was a slow and tedious job.





**F**UNNY-LOOKING gadget, that old-time radio set. Big, bulky horn . . . dials and more dials . . . squeaky and noisy as all get out. Not much like the radio now in your living-room or car. And yet the radio you buy not too long after the war may make your present-day set look and sound as antiquated as that early Electronic instrument looks now. Today Electronics is fighting bril-

liantly for America and its Allies. In battle it warns of approaching danger so we can destroy the enemy; in the electric eye it searches for and exposes flaws in heavy castings; in resistance-welding it doubles and triples production. These and countless others are Electronic achievements of vast importance now and for the future. The First Electronic instrument to benefit will be radio.



For the development and production of Radio Communications Equipment for our Armed Forces, the Motorola organization was awarded the Army-Navy "E" with added Star for continued excellence of performance. Motorola is proud of the part it has been privileged to play in the speeding of Victory.

### Your First Post-War Electronic Purchase Should Be a Motorola Radio

Motorola Engineers are making full use of the newest Electronic knowledge in the production and development of Radar and Communications Equipment now being used by American fighting men on every battle front. Soon after Victory gives the

green light to civilian production, the "know how" of Motorola Engineers will be switched to the production of civilian radios for home and car with the same all-out efficiency and perfection. Expect the finest in Radio from Motorola.

- Take good care of your radio. It is a vital wartime necessity. For service, consult your local classified telephone directory for a nearby Motorola Dealer



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MARCH, 1944**

# Motorola

## RADIO

FOR HOME & CAR

## GALVIN

MFG. CORPORATION - CHICAGO, ILLINOIS





## "Put an End to His Career Pronto"

"In Alaska, I bought a 30-30 Marlin Rifle, a real beauty. I say 'beauty' because up in that country a good gun is a very necessary piece of equipment.

"One morning I was coming home with a nice buck deer on my back. A big, hungry Brownie got the scent and was trailing me...finally caught up with me. That was the first big bear I had the misfortune to meet up with. I aimed for his forehead but, as I was scared stiff, I hit him in the front shoulder.

"He reared up, his big teeth bare, and snarling a plenty. A well-placed shot in his mouth put an end to his career pronto."

...Walter Nowalk,  
Fort Stanton, N. M.

★ ★ ★

We do not recommend a 30-30 for Alaska brown bear, but are glad Mr. Nowalk's Marlin proved so accurate and dependable in this emergency. We do recommend Marlin 30-30's for deer, however, and can promise loyal Marlin users some new "beauties" after the war is won.

THE **Marlin** EST. 1870 FIREARMS CO.  
New Haven, Conn.

★ Turn in your old shells and cartridges to local scrap collection. Metal urgently needed for war production.

## The Flying Cannoneers

(Continued from page 37)

ries and road vehicles. Canadian pilots in P-51s set a record when a pair of them, in half an hour, destroyed a dozen enemy locomotives in France as they flew along the right-of-way at phone pole height.

Other low-flying aircraft, carrying bombs, specialize on railway tunnels. When one can drop a bomb so that it rolls into the tunnel and bursts inside, the pilot has done a good day's work. The caved-in tunnel will stop traffic for days. Britain's Army Co-operation Command estimates some 1,500 locomotives were shot up so badly they needed major repairs last year.

Different versions of the P-51 are equipped with particular combinations of engine and armament for special tasks. A number of Mustangs, equipped with the Rolls Royce engine and two-stage supercharger, are used for combat at high altitudes instead of missions at zero altitude.

Deadly as our flying cannoneers are with the weapons they have today, even greater fire power is proposed. General H. H. Arnold recently announced that among the new weapons of aerial warfare America is preparing are armament that will make our present guns look like pea shooters.

## Liquid of a Thousand Uses

(Continued from page 43)

Scarcity of glycerin has led to frantic searches for substitutes, but so far no one product has been found that will take the place of glycerin in all its applications. Some substitutes, however, have been found for specific uses. Says John R. Beaman, of the Bureau of Foreign and Domestic Commerce chemical unit: "Such chemicals as propylene glycol, diethylene glycol, mannitol, sorbitol, methylcellulose, honey, invert sugar and apple sirups, have been found capable of replacing glycerin in certain uses. Some manufacturers who used glycerin in food products, medicinal preparations, tobacco and cosmetics turned to invert sugar. . . The textile industry discovered sodium lactate and certain glycols can be employed in various processes."

The newly developed apple sirup is being used by the tobacco industry and other experiments are being made with it. Produced by chemically treating apple juice and evaporating and redistilling the sirup, the result is a straw-colored product that is fairly inexpensive when produced on a commercial scale. It is made from off-grade apples, of which in normal years as much

(Continued to page 152)



# Tough but oh so gentle

● If you expect your car to outlast "the duration," keep an eye and an ear on the engine — especially the piston rings.

Worn-out rings bring double-trouble. They waste oil and gasoline, and often cause dangerous cylinder wear.

It's wise to have your motor service man inspect your engine regularly.

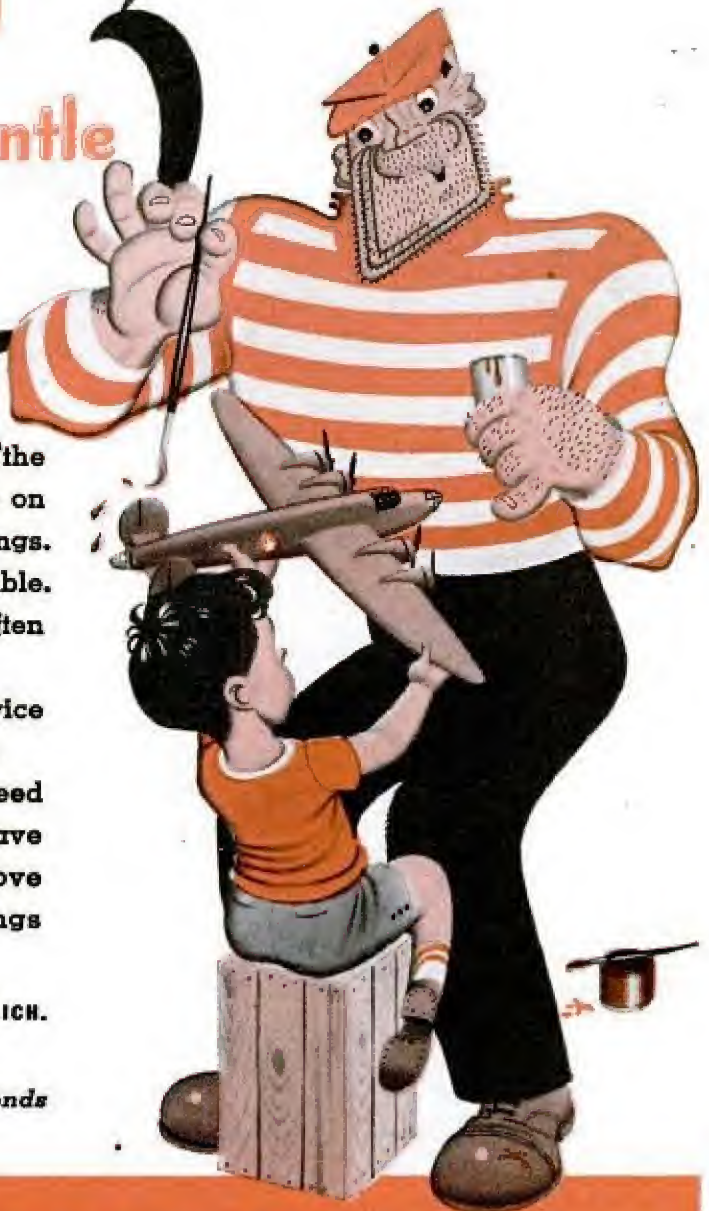
He will tell you when the rings need replacing and show you how to save oil, check cylinder wear and improve engine performance — with Hastings Steel-Vent piston rings.

HASTINGS MANUFACTURING CO., HASTINGS, MICH.

Hastings Mfg. of Canada, Ltd., Toronto



★ It's a privilege to buy War Bonds



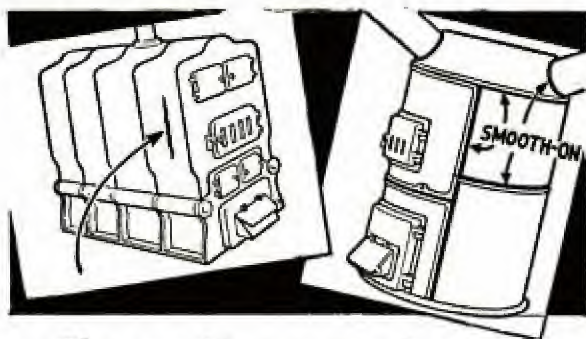
## HASTINGS

STEEL-VENT PISTON RINGS

U. S. Patent No. 2,148,997.

*Tough on oil-pumping. Gentle on cylinder walls*





## Those Furnace Leaks Waste Fuel...

*Stop Yours with*  
**SMOOTH-ON**



SMOOTH-ON No. 1 sold in 1½-lb., 7-lb., and larger containers by hardware stores.

**S**TOP up leaks and cracks in your heating equipment and save precious coal or oil—prevent the discomforts of a furnace breakdown in winter weather.

Seal leaks in boiler, tank, piping and radiators with handy Smooth-On No. 1 Iron Repair Cement. No

experience needed, no heat required. Smooth-On handles like putty, hardens durably. Besides stopping leaks and sealing cracks, Smooth-On tightens loose handles, knobs, casters—does countless home repair jobs.

Keep a can of Smooth-On handy—get it at your neighborhood hardware store. Inexpensive—does not deteriorate . . . and be sure to get the—

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showing, with pictures and simplified descriptions, all sorts of repairs any householder can make. 40 pages. 170 diagrams. Pocket size. Handy index. Send coupon for your copy.



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570 Communipaw Ave., Jersey City 4, N. J.

Yes—please mail me my Smooth-On Handbook.

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Address .....

3-44 .....

*Do it with* **SMOOTH-ON**

as 25,000,000 bushels would go to waste.

Although resins are first on the research program of the Glycerin Producers Association, progress is being made in development of new uses for glycerin in food, including economical quick freezing processes. It has been found that by immersion in this liquid, food products could be frozen quicker and at higher temperatures than by air freezing. Glycerin was used experimentally to make chocolate resist hot weather, and to preserve peanut butter.

## Getting 'Em Ashore

(Continued from page 55)

to the service with the amphibious forces.

Enlisted men are given a tough conditioning course, and then receive basic amphibious training. They learn to clamber over the sides of ships into the small boats pitching below. They are taught to come ashore from landing craft through rough water and still keep their equipment dry. They study the tactics of surprise attacks.

Army officers learn the art of amphibious warfare alongside their Navy brethren. They study strategy and tactics and the proper method of liaison between many organizations involved. Visual and radio communication between shore party, landing craft, naval warships providing supporting gunfire and covering planes, must be understood and co-ordinated.

Army transport quartermasters study the loading of cargo ships and transports. Working with large scale models of the ships attached to the amphibious forces and scale models of the equipment that will be used, the quartermasters work intricate problems of loading and unloading ships.

When all units have completed basic training, they are assembled for advanced training. The crews of landing craft are assigned to transports and LST's on which they will serve. Flotillas of larger landing craft form. Troops board the transports.

Then dress rehearsals of actual landing operations are carried out—in grim earnest because many lives depend upon how these lessons have been learned. Ships are loaded with complete equipment and the convoy sails for a selected practice landing beach. Actual landings are made under simulated battle conditions, with the beach "defended" by opposing troops and with aircraft and warships taking part.

In this manner are the Amphibs being trained to strike. American workers have built thousands of landing craft to put a huge invasion force ashore in Europe. Navy men who will "get the guys ashore" have been trained. The Army is ready.





**WHERE PERFORMANCE REALLY COUNTS..**

*Dependable*  
**.. CHAMPION SPARK PLUGS**  
**ARE ON THE 'FIRING LINE'!**

The high degree of maneuverability, that makes self-propelled artillery so effective, depends on an engine not unlike the one in your car, and as in your engine spark plugs are vital to its performance and dependability. Champion Spark Plugs are on the firing line with our armed forces on land, water and in the air pre-



cisely because they are living up to their reputation for absolute dependability. Literally untold millions of Champions are in daily use by our armed forces on land, water and in the air on every front. This is the greatest tribute ever paid to the traditional dependability of Champion Spark Plugs.



**TO SAVE GASOLINE—KEEP SPARK PLUGS CLEAN**

**LET'S ALL BACK THE ATTACK—BUY WAR BONDS**

MARCH, 1944



# Prevent those Heatless huddles



## STEP UP YOUR COMFORT WITH BALSAM-WOOL ATTIC INSULATION



Even though fuel must be saved, you don't need to sacrifice comfort! Balsam-Wool Insulation—applied in your attic—will keep your home warmer—more comfortable—with fuel savings up to 20%. It's the sensible, patriotic way to cooperate with the government fuel conservation program!

Balsam-Wool is the famous, original blanket-type insulation . . . an insulation that has proved its lasting efficiency in hundreds of thousands of homes. That is why it is offered under a money-back guarantee of complete satisfaction. And remember, Balsam-Wool is easily applied—laid like a carpet in your attic. Windproof, moistureproof and fire resistant, it has everything an insulation needs.

See your **lumber dealer**—now—about applying Balsam-Wool, and ask him about a monthly payment plan. Or, mail the coupon for complete information.

# Balsam-Wool

**SEALED ATTIC INSULATION**

Balsam-Wool . . . Products of Weyerhaeuser . . . Nu-Wood

**WOOD CONVERSION COMPANY**  
Dept. 210-3, First National Bank Bldg.  
St. Paul 11, Minnesota

Gentlemen: I want to know more about Balsam-Wool Double-Value Attic Insulation.

To assist us in giving you special information, please check: I am a home owner ☐  
renter ☐ architect ☐ contractor ☐  
student ☐

Name .....

Address .....

City ..... State .....



## Air Highways of 1950

(Continued from page 59)

approximating great circle routes, between large terminals, by-passing points of congestion. Terminals enroute will be connected to the through airway by their own group of facilities—a radio range to provide a flight path to and from the airway and holding flight path. Holding points will be located to make possible efficient blind landing procedure. Thus will be provided the basic system of trunk and feeder-line airways. In addition, it is planned to establish intermediate frequency omni-directional radio markers throughout the country for long-distance aircraft at higher levels using direction-finding apparatus.

It is believed the solution to the problem of controlling large numbers of aircraft will not be attained until some anti-collision device is available in each aircraft. Development of one such device was started well before this country entered the war. Unfortunately, all work on this is suspended for the duration. It is expected that signals representing the altitude of other aircraft would be shown on a screen. The vertical position of aircraft within 1,500 feet above and below and within 10 miles of the instrument will be known to the pilot. On another device conceived by CAA, the size of a dot on the screen would represent the distance to aircraft ahead. A plane straight ahead and on the same level would appear first as a pinpoint at the center of the screen. As the plane drew nearer, the size of the dot would increase but its location on the screen would remain unchanged. As the pilot changed course to the right, the dot would move to the left.

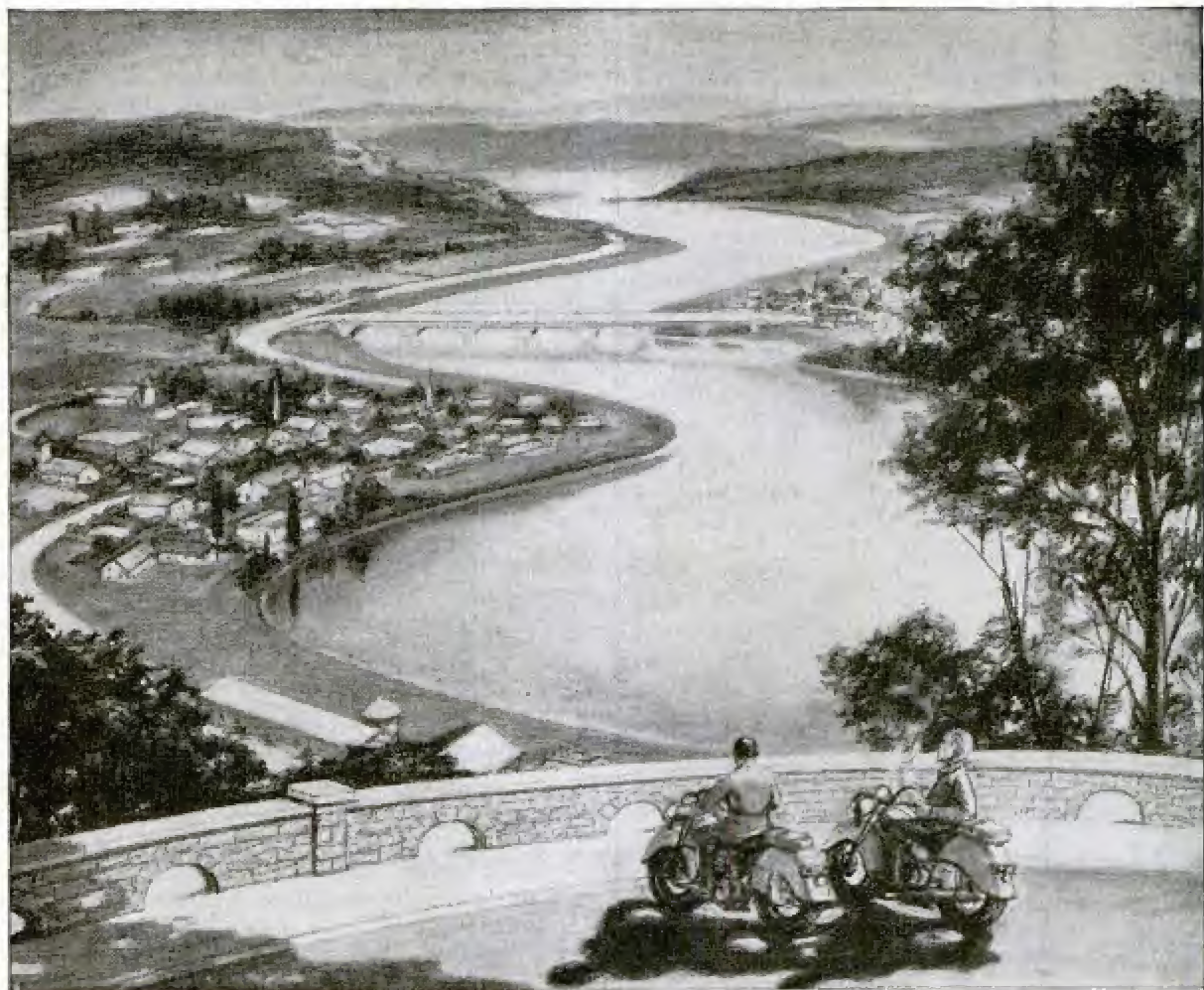
Progress reports from the pilot to a communications station for relay to control centers consume considerable time and work. Automatic position reporting equipment will remove the necessity of this operation. As aircraft proceeding along an airway pass through a radio "screen," identification signals and altitude information, emanating from the aircraft automatic transmitter actuated by the "screen," are picked up by receivers on the ground and transmitted to the control center.

To expedite traffic at terminals, it will probably be necessary to enable airport controllers to view traffic by means of detection equipment when weather conditions prevent actual sight of the aircraft.

One screen in the control tower would indicate the horizontal position of aircraft approaching for a landing in relation to each other and their distance from the air-

(Continued to page 156)





INDIAN  
TRAIL BLAZERS



## *High on a Hilltop*

You and your Indian look down on broad rivers, mighty forests, and waving fields of grain. There's nothing like an Indian Motorcycle to take you places. No other means of transportation makes you feel so much a part of the scene. Astride an Indian you're out of the monoxide line of traffic... effortlessly and smoothly you reel off your miles of adventuring... slip off the highways into unexplored side roads that lead close to the heart of this great land of ours... Your Indian always responsive, easy to handle, safe. Plan to join the great

fellowship of motorcyclists when our fight for freedom is finally won. Get acquainted with your Indian dealer now.

### INDIANS ON THE WARPATH

Right now, all new Indian Motorcycles go straight to war, and what a fighting record they're turning in! But new, improved, postwar Indians are already being blueprinted. *They're the motorcycles to wait for!*



**BUY WAR BONDS NOW  
TO BUY AN INDIAN LATER**

Indian Motorcycle Company  
Springfield, Massachusetts

Mail FREE copy of exciting Indian News.

Name.....

Address.....

City.....State.....

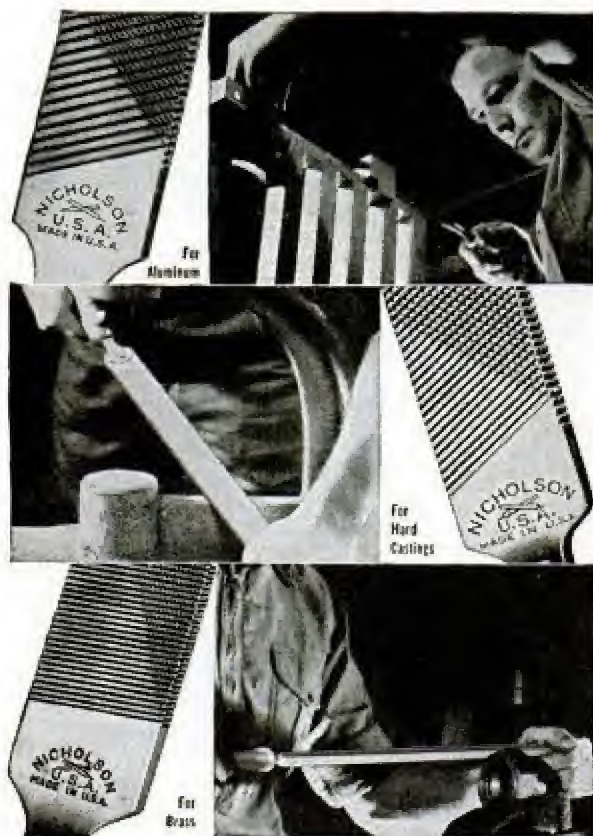
# Indian

## MOTORCYCLES

MARCH, 1944

155





## NAME THE JOB ... we'll furnish the file

• No longer does efficient shop practice condone the use of files unsuited to the job in hand. Today files and filing techniques are highly specialized. Metals and metal-alloys differ widely. Their actions on files vary greatly. Desired filing results are many.

The skilled mechanic must *know his files*—whether in operating his own shop or seeking to advance himself in industry. *The right file for the job* means faster production, less faulty work, greater earnings.

To the "home mechanic" with a flair for making useful things or needful repairs, there's the pride of working with an assortment of good files.

Nicholson is the leading manufacturer of *files for every purpose*. Ask hardware or mill-supply dealers—or "the boss"—for the kind you want . . . in Nicholson or Black Diamond brand.

**"FILE PHILOSOPHY"** — the Nicholson 48-page book on kinds, use and care of files, will help any mechanic become more valuable to himself and to his employer. **FREE.**

**NICHOLSON FILE CO., 22 Acorn St., Providence 1, R. I., U.S.A.**  
(Also Canadian Plant, Port Hope, Ontario)

**NICHOLSON**  
**FILES** FOR EVERY  
PURPOSE

NICHOLSON  
U.S.A.  
MADE IN U.S.A.

port. A second screen would show vertical position of aircraft in the control zone. Combining both screens and identification of the aircraft in a single screen or other device is highly desirable.

We may expect larger and faster aircraft for long-distance transportation. Aircraft of about the present airline size and speed probably will be continued for short-haul transport and feeders to main routes. Relatively slower aircraft and helicopters will be used for commuting services and mail and cargo pickup. The speed and size of private aircraft are expected to vary from that of the airliner to the helicopter. The business man will find the private plane a necessity for his daily affairs. This will add to the problems of traffic control.

Air space will be stratified. City-to-city traffic will probably continue on the present airway system at lower levels. As routes are added from smaller cities to the main airways, control procedures must be devised to permit aircraft on these routes to enter or cross principal airways at specified points without hazard to other craft.

It is expected that long-distance traffic above 12,000 feet will be directed by automatic direction-finding equipment. Altitudes will be assigned according to destination and route. Upon reaching the assigned altitude the direction-finding equipment would be tuned to the appropriate non-directional radio beacon and a direct course followed to that point. Ocean traffic may be handled by direction-finding homing stations on ocean seadromes or islands.

## The Weatherman Goes to War

(Continued from page 11)

apparent just how competent they are. A.A.F. weather technicians operate stations at air fields in many parts of the world. They prepare summaries of local weather at six hour intervals for transmission to broadcast centers. These station reports plus reports from other branches of the service, together with information from civilian sources, are then relayed to all stations in code. This arrangement provides the weather man at any field enough information to prepare forecast maps.

Certain stations send up pilot balloons every six or 12 hours to obtain wind directions and velocities at upper altitudes. Additional details for such a three-dimensional picture of the weather are obtained at a number of fields where radiosonde balloons are released, carrying aloft tiny lightweight weather instruments coupled to a miniature radio transmitter which relays to the

(Continued to page 158)



# THE *HOW AND WHY* OF

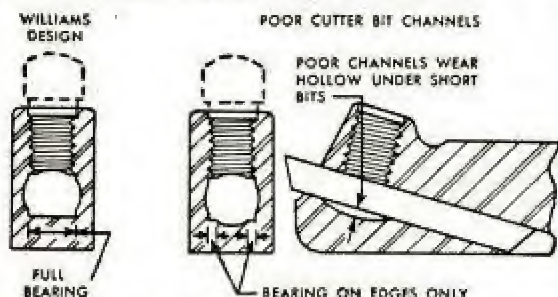
# WILLIAMS

## DROP-FORGED TOOLS

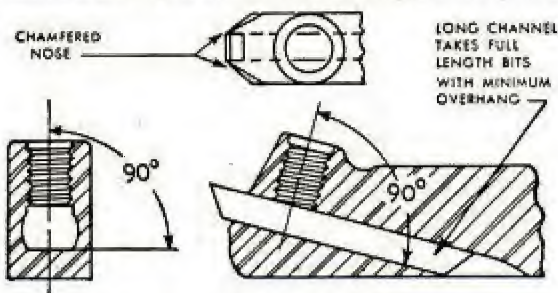
### DATA ON WILLIAMS' TURNING TOOLS

(Data Sheet No. 7)

Tool Holders must be engineered to withstand the severe treatment which modern metal turning imposes on the cutting tool. Williams' Holders are drop-forged from a specially selected grade of steel, treated and hardened to develop maximum resistance to all wear and insure a hard rigid seat for the cutter directly under the holding or locking device. This tends to prevent cutter breakage which is due largely to the recess or pocket formed by short bits being forced into the cutter seat of the holder when the shank has not been properly hardened.



In Williams' Turning Tool Holders the nose is chamfered to permit convenient use in close quarters where space is limited. Set Screws are located at exact right angles to the cutter bit channel to provide full contact of the point of the screw with the cutter bit and insure maximum holding power. Screws

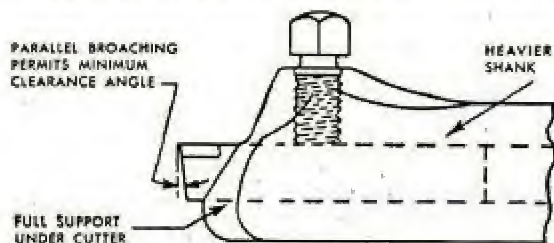


and tapped holes are held to the close fits essential for long life under gruelling tool holder service. Note that the extremely long cutter bit channel extends thru the bottom face of the shank, providing maxi-

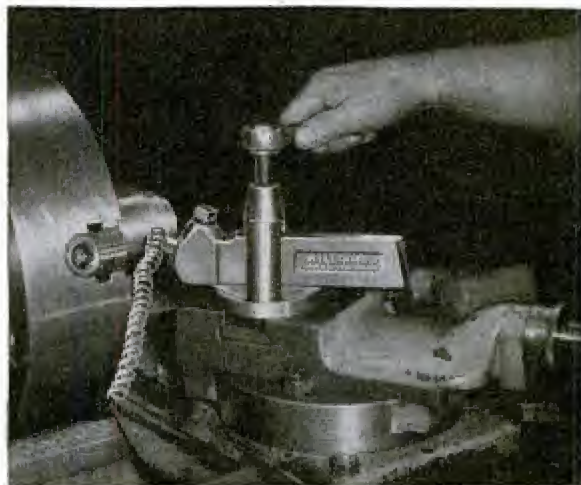
mum entry for the cutter bit. This feature assures minimum overhang when a *full-length* bit is used, thus reducing the danger of cutter bit breakage.

### Carbide Turning-Tool Holders

The brittle nature of tungsten carbide makes it absolutely essential that the bit be held rigid and the cutting edge supported as much as possible. To



accomplish this, the shanks of Williams' Carbide Holders are made heavier and longer than regular Holders of equal cutter capacity. The cutter channel is broached parallel with the base of the shank rather than at the usual 15° angle. The parallel broaching of the cutter slot permits proper grinding of the cutter so as to give maximum support to the cutting edge.



**J. H. WILLIAMS & CO., BUFFALO 7, N. Y.**  
**ON USE OF SHOP AND HAND TOOLS**

# FREE DATA SHEETS

Your name and address in the margin below will bring 11 Tool Holder Data Sheets (punched for 3-ring binder) and a list of our complete Data Sheet series. Mail to above address, Dept. PM-3.





## AC SPARK PLUGS

**MILLIONS OF WAR  
WORKERS CONSERVE  
THEIR SPARK PLUGS  
BY HAVING THEM  
CLEANED AND AD-  
JUSTED REGULARLY.  
TO BE SURE OF UT-  
MOST RELIABILITY  
WHEN PLUGS MUST  
BE REPLACED, THEY  
SPECIFY NEW AC  
SPARK PLUGS.**

**Let's ALL BACK THE ATTACK with WAR BONDS**

ground the temperature, pressure, and humidity conditions at different altitudes.

In addition to the technicians who prepare forecasts, there are staff weather officers who interpret the forecasts in terms of the special needs of the units to which they are attached. Each knows the pilots in his command and how high, how fast, and how far the airplanes in his group can fly.

It took special, intensive training to build up the personnel for the expanded Weather Service. The best meteorologists in the United States were put in charge of special classes at five major universities. Hundreds of young meteorologists graduated from the weather courses are in active service on every continent.

Modern forecasting is based on air mass analysis, a technique originated in Norway and refined by both Americans and Germans. Very precise predictions can be made up to a week or more in advance.

In the northern hemisphere the general trend of the weather is from west to east. A forecast must be based on reports from hundreds of stations, most of them from stations west of the area involved. With the Japs and Germans confined to their territories and with the Allies free to collect weather information over most of the rest of the globe, our forecasters have more complete data with which to work.

Weather information is so important that German submarines on Atlantic patrol radio conditions to Europe. Germany has sent weather planes far out over the Atlantic for observations. Our pilots make complete reports of weather they encounter after every flight into enemy territory.

The world's weather is being studied more closely than ever before. The result will be, after the war, that forecasts will be much more accurate than in the past.

### Surprise Weapons of War

*(Continued from page 5)*

ergized ring fastened to the wings of Wellington bombers. The ring causes the mines to explode harmlessly.

More recently, the Germans are believed to be experimenting with a torpedo guided by sound. This weapon is said to be equipped with a sensitive wave response mechanism capable of picking up the vibrations of a propeller. The general course of the torpedo is set by conventional gyroscopic gear, but when it nears a ship the sound wave apparatus takes over and steers the torpedo directly into the propellers. The Germans are also reported to be using an electrically driven torpedo that

*(Continued to page 160)*



"SWEETHEART," HE SAID SOFTLY, "THEY  
COULDN'T KILL A GAL LIKE YOU..." He touched  
the tank tender-like. Nazi shells had ripped into  
her heart... You'd think she would have died with two-  
fifths of her engine knocked out... but she didn't!...  
she kept rolling along as though  
nothing could stop her.



NOW, the heart of that General Sherman tank was not one engine... but  
five, hooked together... and all five are the same six-cylinder jobs you have in your  
Chrysler. These engines can run on their sides... on their backs. And even when two are  
destroyed by enemy fire, the other three can keep the tank rolling. You can credit  
Chrysler Division "know-how"... and an alert U. S. Ordnance Department for this one.

**WAR PRODUCTS OF CHRYSLER DIVISION**

Industrial Engines • Marine Engines • Marine  
Tractors • Navy Pontoons • Harbor Tugs •  
Anti-Aircraft Cannon Parts • Tank Engine  
Assemblies • Tank Parts • Airplane Wing  
Panels • Fire-Fighting Equipment • Air Raid  
Sirens • Gun Boxes • Searchlight Reflectors.

**CHRYSLER**



**DIVISION OF CHRYSLER CORPORATION**

**BACK THE ATTACK WITH WAR BONDS!**

**THE NATION-WIDE CHRYSLER DEALER ORGANIZATION OFFERS OWNERS SERVICE FACILITIES TO MEET THEIR TRANSPORTATION NEEDS**



# Wanted

## POSTWAR PRODUCTS

- ★ **Have you a postwar product**—a patent or patent application—a fully-developed commodity with national volume sales possibilities that can be produced in whole or part from metal stampings? Write us about it now.
- ★ **More than a quarter century's experience** in the fabrication and assembly of metals of all descriptions, plus expanded facilities and skilled manpower, will enable us to manufacture and merchandise soundly-designed, new products for peacetime demands.
- ★ **We will acquire the items** selected by our Postwar Products Committee either by purchase, royalty or contract.
- ★ **If you know of a product** that you believe we can manufacture to advantage, please send complete information by letter, accompanied by blueprints, drawings or sketches.
- ★ **Your suggestions will be acknowledged.** We will review them with care and interest, and arrange for a personal interview if we wish to consider them in detail.

Please address:

*Postwar Products Committee*

**THE GEOMETRIC STAMPING COMPANY**  
1125 East 200th Street • Cleveland 17, Ohio

# GEOMETRIC

does not leave a wake of bubbles behind it.

The two-man Jap submarine which carried two 18-inch torpedoes and a charge of high explosive under the stern was an innovation early in the war. This baby sub, with limited cruising range of 200 miles at low speed, has not been much of a success, according to reports. The British, however, in the pattern of alert nations at war, are believed to have taken a cue from the Japs in the development of a midget submarine that recently made a sensational debut. These tiny subs were used to penetrate a mine field along the coast of Norway and cripple the 35,000-ton German battleship Tirpitz. When the Italian fleet surrendered, among the craft turned over to the Allies were new models of a midget sub.

There is some basis for the statement that Yankee ingenuity is leading the world in the creation of surprise weapons. The Office of Scientific Research and Development in Washington, whose business it is to pioneer in army and navy secret weapons, has produced no less than 200 unpublicized weapons and improvements to military equipment since we entered the war.

The importance with which Congress regards this agency is evidenced by the size of its 1944 budget—\$135,982,500. This budget survived congressional hearings without one penny being deducted from the amount requested. About \$46,000,000 will be spent for electronics research and "radio co-ordination"; \$20,000,000 will be devoted to the science of submarine destruction, and some \$11,000,000 are earmarked for "special projectiles."

Since this agency began to function, the armed services have let contracts for \$2,000,000,000 worth of the products it has been instrumental in developing. A single discovery saved \$100,000,000 in plant construction by simplifying the manufacture of an explosive.

It's a safe bet that when more deadly secret weapons make their appearance they will bear the mark: "Made in the U.S.A."

### Rocket Kite Takes Aerial Aloft To Send Distress Signals

Launched by rocket pistol, a kite developed for the Army and Navy carries an aerial aloft to aid in sending out distress signals. Additional height achieved by rocket propulsion greatly increases the range of the transmitter. The kite is being made both in the United States and England in accordance with an arrangement for the exchange of patents during the war.



# There's been a big change



● Progress is inevitable. Sports have become more skillful, science more exacting, industry more efficient.

When the users of heavy-duty equipment demanded a better tapered roller bearing, Tyson introduced the "All-Rolls" design. This improved bearing, containing *thirty per cent* more rollers, has found wide acceptance

in transportation, industry and agriculture—wherever the going is tough.

Tyson's extra rolls mean more than greater load-capacity. They give the bearing more strength and rigidity, substantially longer life, added efficiency.

\* \* \*

*The big name in bearings today is . . . TYSON!*



TYSON BEARING CORPORATION, MASSILLON, OHIO

COUNT THE ROLLS - THE ROLLS COUNT



# Tyson

**TODAY'S HEAVY-DUTY BEARING**

★ LET'S ALL BACK THE ATTACK ★



# RED-ITCHY SKIN?

watch out—it's often

# ECZEMA

**Home  
Treatment  
Promptly  
Relieves  
Torture!**



First applications of wonderful soothing medicated *liquid Zemo*—a Doctor's formula—quickly relieve the intense itching burning of Eczema, Psoriasis and similar annoying skin and scalp irritations due to external cause. Zemo also aids healing. Amazingly successful for over 35 years! Apply anytime—doesn't show on skin. First trial of clean, stainless *liquid Zemo* convinces! 3 different sizes. Buy Extra Strength Zemo for stubborn cases. All drugstores.

## ZEMO



### GERSTNER Tool Chests

Better, finer, more desirable. Free catalog for machinists and toolmakers.  
GERSTNER TOOL CHESTS  
444 Columbia St. Dayton 7, Ohio



### Weldwood Glue Has Everything:

Scientific shear tests prove that Weldwood Glue "makes the glue line the Safety line." It is actually stronger than the wood it joins!

Your hardware store or lumber dealer has handy packages of Weldwood Glue in 10c, 25c, 50c and 85c (1 lb.) sizes and 5 lb. cans. Get a can today or send 25c and your dealer's name for a trial 3 1/4 oz. sample.

1. Tremendous strength. 2. Waterproof, bacteria- and rot-proof. 3. Quick and easy to use. No heating. No waiting. Mixed just by adding water to powder. 4. Economical. 5. Applied cold, quick-setting. 6. Stain-free. Supply limited due to Uncle Sam's war needs.

UNITED STATES PLYWOOD CORPORATION  
Weldwood Glue Dept. 38, 55 W. 44th St., N.Y. 18, N.Y.  
"Makes the glue line the SAFETY line"

## WELDWOOD

PLASTIC RESIN  
WATERPROOF GLUE



## 'Mail Order' Service for Warships

(Continued from page 31)

at its destination, 10,000 air miles from Washington, D. C., by the time the cables had been ripped out!

An aircraft carrier was damaged in battle and required replacement of heavy aircraft elevator plungers and ammunition hoists. The Bureau of Ships got a hurry-up request. The Navy Yard at Norfolk, Va., finish-machined a plunger intended for another vessel. The inspector of naval material at Camden, N. J., arranged for delivery of the ammunition hoists. The plungers and hoists were sent to the Pacific Coast, placed aboard the first ship heading west and within 6 days of the time the first dispatch had been received were in the hands of the carrier's engineers.

A heavy cruiser required electric controllers for a pump before she could sail. The controllers were located at a Gulf Coast yard—waiting to be installed on another vessel at a later date.

"We'll swap you," said the officer in Washington.

"It's a deal," replied the manager of the Gulf Coast Yard, "just be sure we get the stuff when we need it."

The controllers were shipped to the cruiser by air express; the cruiser's own controllers later were sent to the vessel in the Gulf Coast yard. The cruiser returned to action several weeks earlier than otherwise would have been possible.

Much of the credit for getting America's ships and planes into action without loss of a minute should go to the manufacturers.

At 7:30 one evening, the Bureau of Ships was informed that a Diesel engine water jacket and lubricating oil cooler had to be aboard a ship at Bayonne, N. J., the next day. An officer telephoned the manufacturer at Rochester, N. Y.

"We've got none, either," the manufacturer said, "but we've got some unfinished parts that aren't painted."

"There's a plane at 11 p.m. Can you get the stuff aboard?" asked the officer.

"I'll drive it to the airport myself."

The stuff arrived at Bayonne the next morning and started overseas.

A submarine en route to the war zone had a serious engine failure. The skipper asked for parts to be delivered to an intermediate base on its route. All parts were delivered before the submarine arrived!

The Navy believes that by getting ships and planes into battle quicker, the war will be ended just that much sooner. Thus it has perfected the "mail order" service for warships, its world-wide maintenance system which keeps planes and ships fighting.

POPULAR MECHANICS



# AUTO-LITE SPARK PLUGS

IN SERVICE ON EVERY FRONT



"Gran'paw's jinin-up — sez you gotta fight skunks with skunks."

## JOIN UP FOR THE WAR ON GAS WASTE

One big gun in the war on gas waste is Auto-Lite's "Plug-Chek" Inspection Service. For you may increase your gas mileage as much as 12% with Auto-Lite's "Plug-Chek," according to tests conducted by the American Automobile Association. As simple an operation as cleaning and regapping your present spark plugs may be all that is necessary. If you need new plugs, insist on ignition engineered Auto-Lite's. Get a "Plug-Chek" at your dealer's.


THE ELECTRIC AUTO-LITE COMPANY  
TOLEDO, 1 • Merchandising Division • OHIO

*Tune in*  
**AUTO-LITE'S**

GREAT RADIO SHOW  
STARRING  
**RONALD COLMAN**  
IN  
**"EVERYTHING FOR THE BOYS"**

Tuesday Night . . . NBC Network  
Featuring men and women at the fighting fronts







**TO THE WORLD...**

they gave the miracle of Radium...

**TO EACH OTHER...**

they gave a wonderful love.

**TO YOU...**

their story brings a memorable motion picture experience...

**M-G-M**

*presents*

**G R E E R**

**G A R S O N**

**W A L T E R**

**P I D G E O N**

**IN**

**M A D A M E**

**C U R I E**

Directed by MERVYN LeROY

Produced by SIDNEY FRANKLIN



A METRO-GOLDWYN-MAYER PICTURE  
with a brilliant supporting cast • Henry Travers  
Robert Walker • Dame May Whitty • Elsa Basserman  
Van Johnson • Albert Basserman • C. Aubrey Smith  
Victor Francen • Reginald Owen • Margaret O'Brien

Screen Play by Paul Osborn and Paul H. Rameau  
Based on the book, "Madame Curie" by Eve Curie

POPULAR MECHANICS



# You owe it to your Uncle Sam!

*He needs manpower—every available person. A hearing deficiency may keep you out of the armed forces . . . but you can do your fighting on the home front . . . in war material plants. A good hearing aid enables you to go all out in the war effort. The movement is growing. In our plant today are workers wearing hearing aids and contributing as competently as if their hearing were normal.*



## The New Zenith RADIONIC HEARING AID

ACCEPTED

By  
American Medical Association  
Council on Physical Therapy.

**\$40<sup>00</sup>** READY TO WEAR

Complete—with Radionic Tubes—  
Crystal Microphone and Batteries  
... *Liberal Guarantee*

## You owe it to your friends!

They want to enjoy your company as much as you do theirs.  
Your hearing aid means as much to them as it does to you.

## Are you really doing your part?

That question only *you* can answer. *Think!*

## Report on a Revolution

Zenith recently started a revolution—to reduce the *cost of hearing*. After years of research and preparation, the Zenith Radionic Hearing Aid is now offered to the public.

The price—\$40—(about one-quarter that of other good vacuum tube instruments). Complete—ready to wear—with miniature radio tubes, crystal microphone and batteries—liberally guaranteed.

Inquiries from everywhere have flooded the mails—telephone calls—telegrams.

A sales volume—unheard-of in this field—is gaining daily momentum—and is a demand created by

self-evident merit of the instrument itself. Today our problem becomes one of production and distribution—to as quickly as possible make the Zenith Radionic Hearing Aid available in all localities.

We are doing our best to furnish additional manpower for Uncle Sam's production forces. And—in the doing—we are experiencing that rare satisfaction born of directly contributing to the welfare of individuals.

THE ZENITH HEARING AID WILL BE AVAILABLE THROUGH REPUTABLE OPTICAL ESTABLISHMENTS FRANCHISED BY ZENITH, (NO HOME CALLS OR SOLICITATIONS) Write us for address of outlet nearest to you.

ZENITH HAS BUILT THE BEST THAT MODERN knowledge and *radionic* engineering make possible into this \$40.00 hearing aid. It has no other models . . . *one model . . . one price . . . one quality.*

There are cases in which deficient hearing is caused by a progressive disease and any hearing aid may do harm by giving a false sense of security. Therefore, we recommend that you consult your otologist or ear doctor to make sure that your hearing deficiency is the type that can be benefited by the use of a hearing aid.

### TO PHYSICIANS:

A detailed scientific description will be sent upon request. Further technical details will appear in medical journals.

*Write for Free Descriptive Booklet*

ADDRESS DEPT. PM-3, HEARING AID DIVISION  
**ZENITH RADIO CORPORATION**  
CHICAGO 39, ILLINOIS



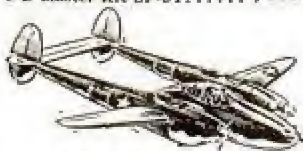


# "CLEVELAND MODELS" Now Bring You a Realistic 3/4" Scale Model of the Plane that's Front Page News Everywhere



No. Amer. "MUSTANG" (P-51)

Tough, vicious fighter. First American fighter over Germany itself. 350 mph. Span 27 3/16". C-D Master Kit SF-91..... \$3.00



Lockheed P-38 "LIGHTNING"

Deadly interceptor due to its super-speed, high ceiling, and terrific diving power. Span 38 3/4". C-D Master Kit SF-85..... \$4.00



Grumman F4F "WILDCAT"

"Ace of the Pacific." Regular "wildcat" in action. Span 26 1/4". C-D Master Kit SF-83..... \$3.00

## ★ DeHavilland "MOSQUITO"

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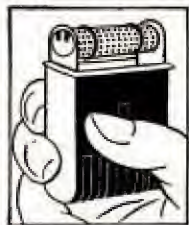


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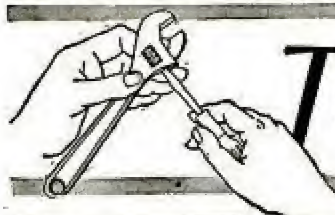
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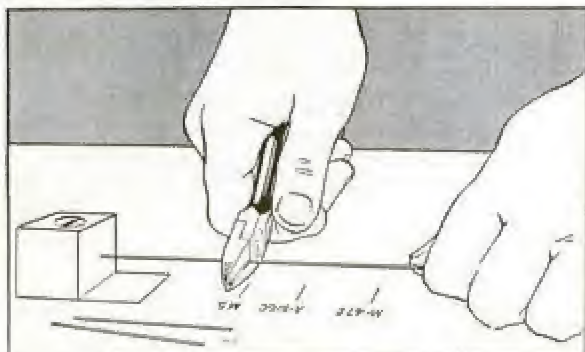


# TOOL NOTES

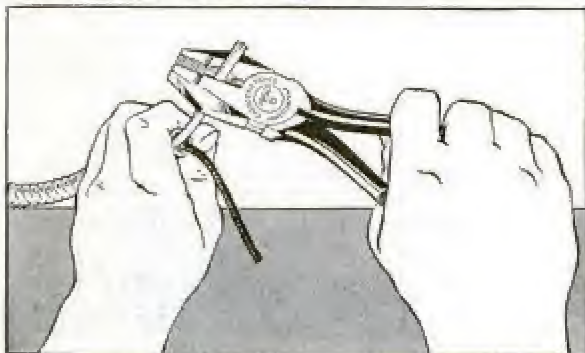
Maintenance  
and Repair  
Suggestions to  
Prolong Tool Life

## No. 15 . . . . . PICKING THE PROPER TOOL FOR THE JOB

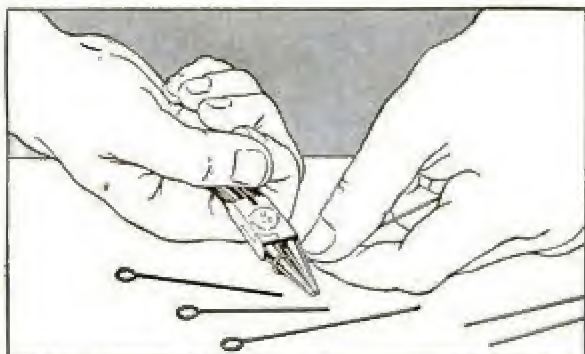
Here is another in the series showing how to use the right tool *properly* for a *particular* job. Following such a procedure inevitably saves time and results in a more workmanlike job.



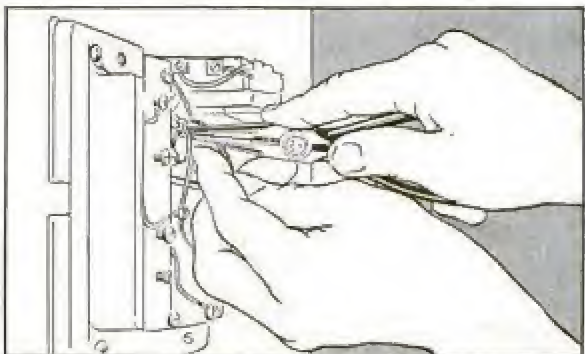
In production work, where light wire must be cut often as part of a work sequence, use **CRESCENT DIAGONAL CUTTER WITH SPRING**. The small spring keeps the jaws apart and ready for the next cut. Example: Assembling radio tubes.



Hand tools can be overloaded. For cutting heavy insulated wire use **CRESCENT LINEMAN'S SIDE CUTTING PLIERS**—they're designed to meet the toughest assignments. Jaws of lighter pliers can be sprung or broken on "over-capacity" work. Example: Cutting heavy, insulated wire.



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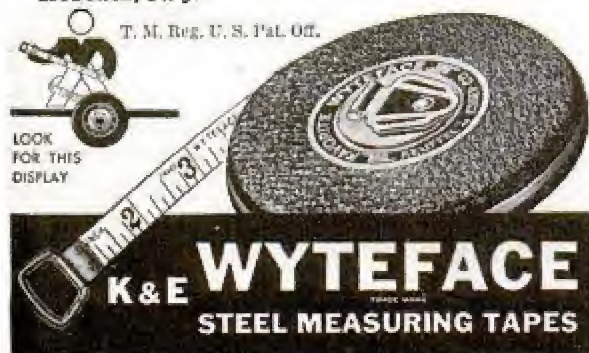
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In peace and in war the leading manufacturer of  
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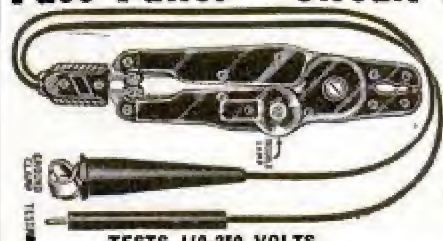


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TESTS 110-250 VOLTS

When motors stop and lights go out, this tool quickly **LOCATES DEAD CIRCUITS** and safely removes blown Fuse. The Star Test Pocket Plier is made of a Transparent Plastic having in one of the legs a small lamp in series with a resistance and can be used to test 110 to 250 volts circuit. The Plier will pull fuses from 10 to 100 Amperes. Thousands of Electricians find this tool handier than Test Lamps. Price \$2.75 each without Leads, \$1.50 additional for Leads, plus 10c postage. Can be obtained from General Electric or Westinghouse Stores or directly from us. Order NOW. **STAR PLIER CO., 233 Canal St., New York 13, N. Y.**

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HM-8

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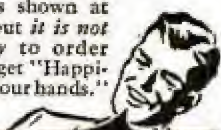
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Homecraft is a hobby which can pay its own way — with something to spare. Not only can you save money by doing your own minor repair jobs, but you can follow the example of others who have built profitable businesses, making small furniture pieces, etc.

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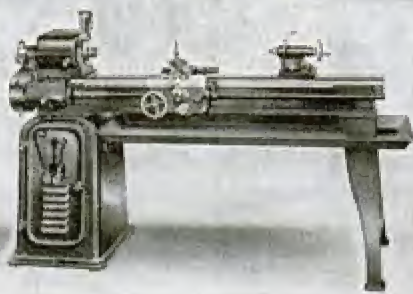
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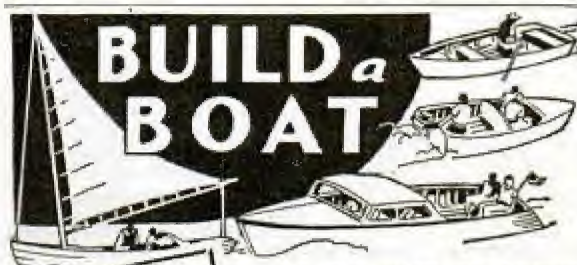
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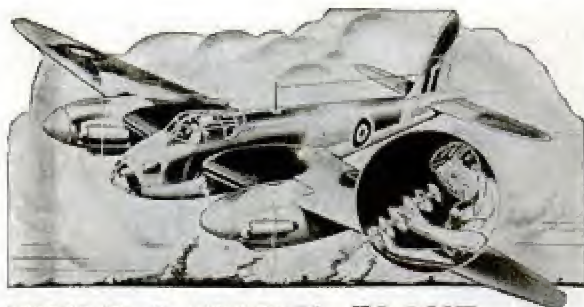
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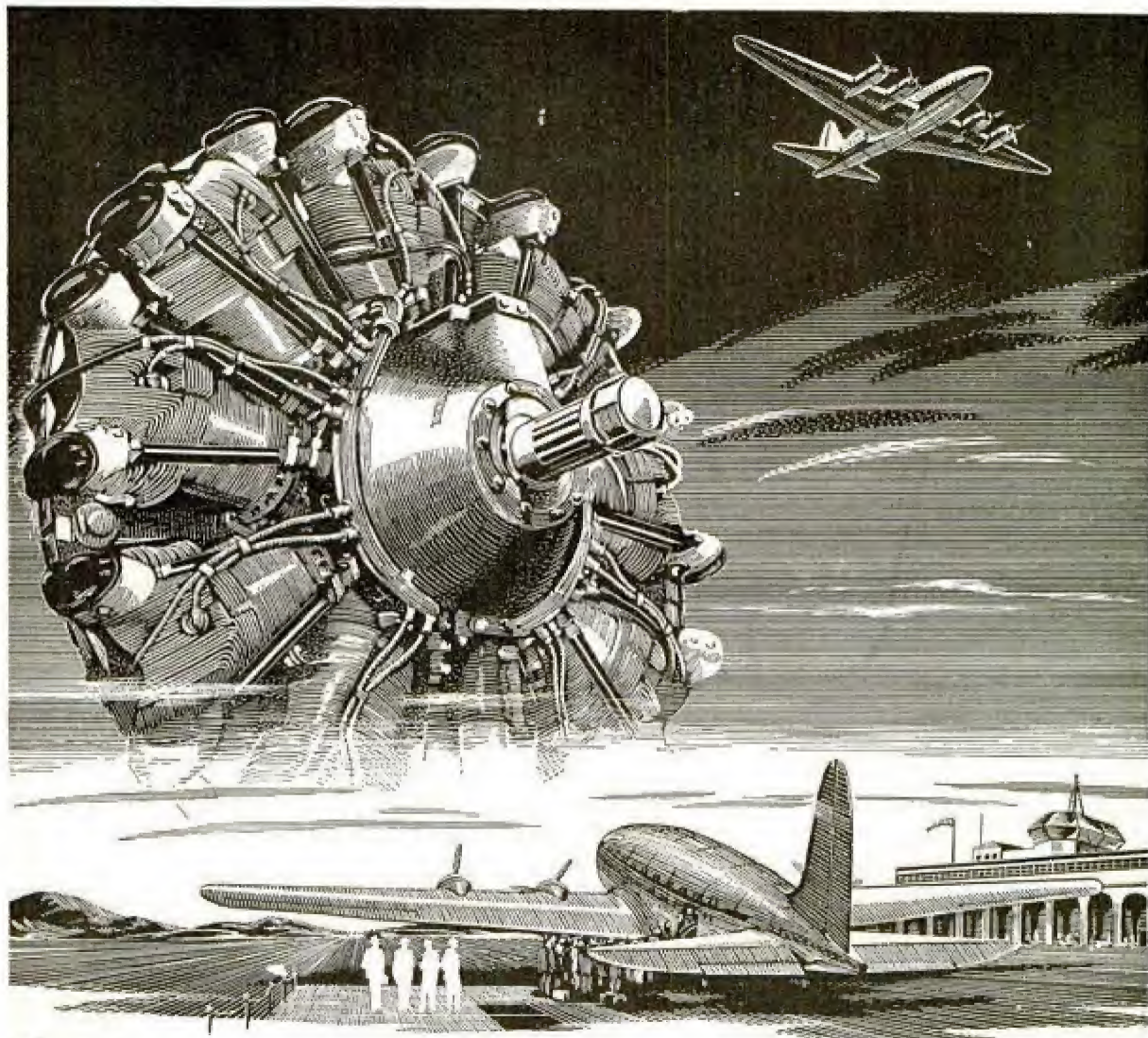
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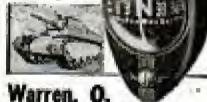
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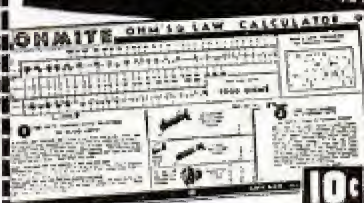
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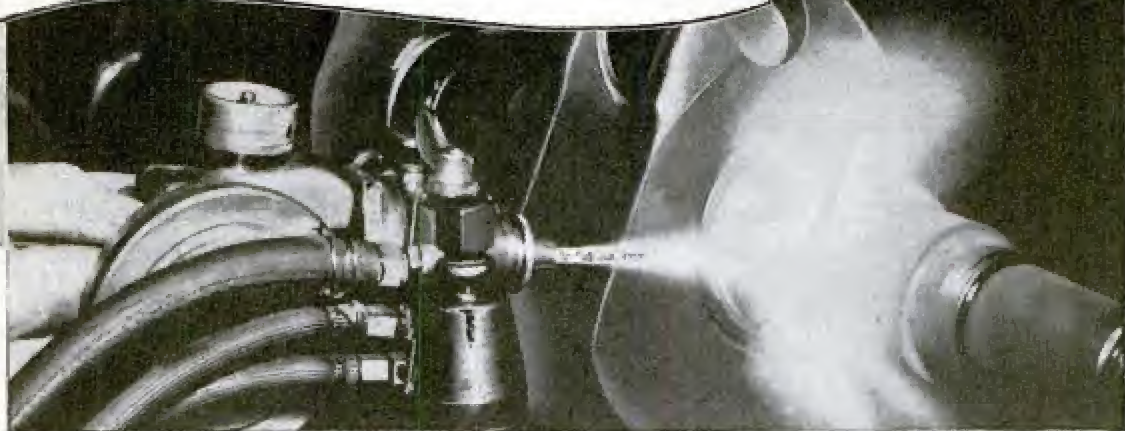
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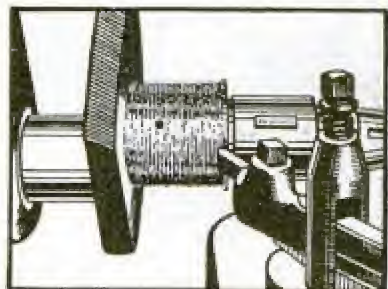
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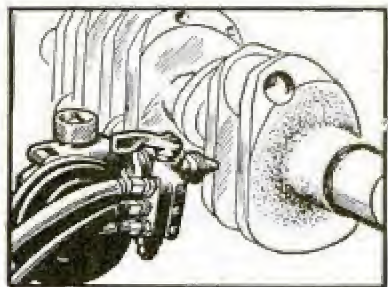
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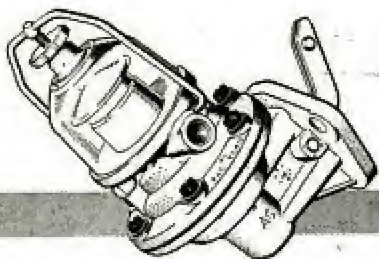
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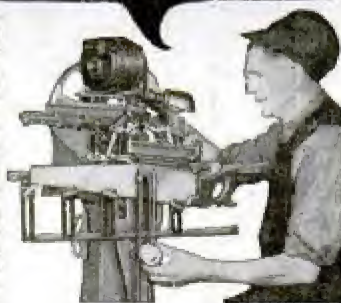
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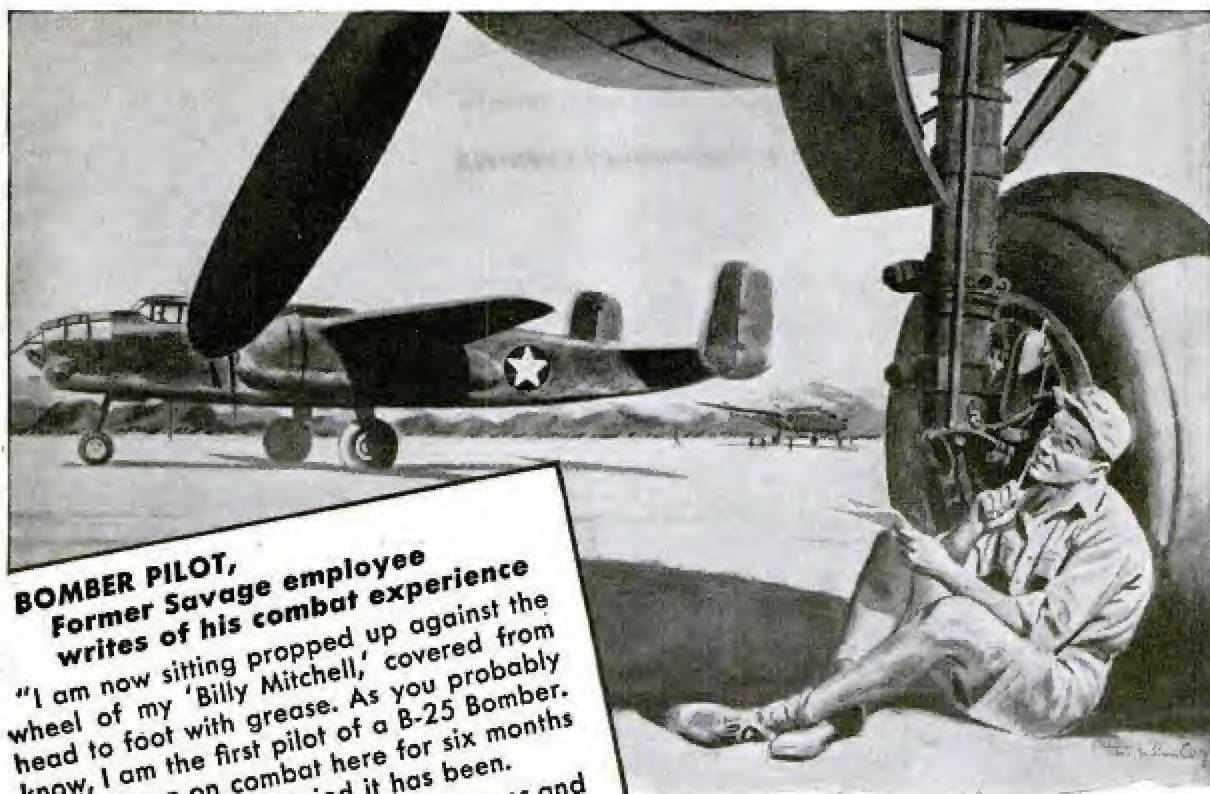
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115 1/2" 19.4375 ea. 23.85  
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116" 19.5





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**"Keep up the good work"**

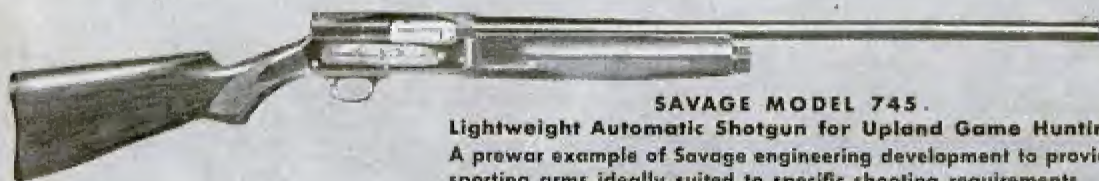
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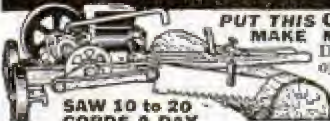
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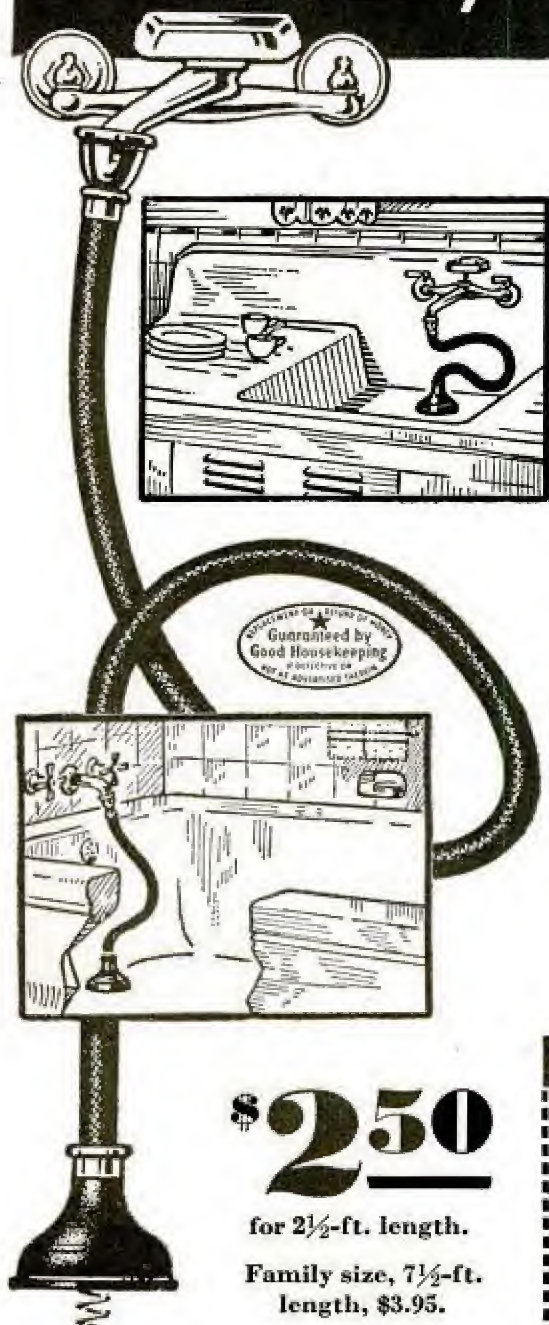
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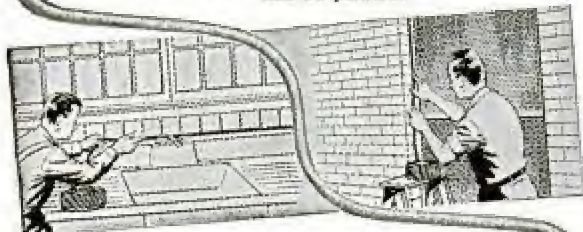
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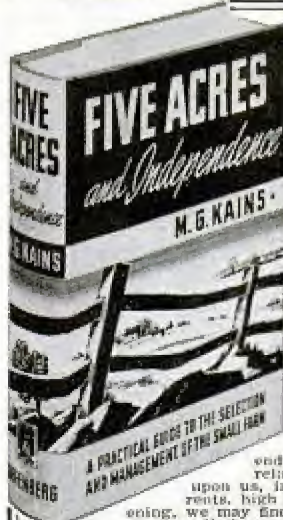


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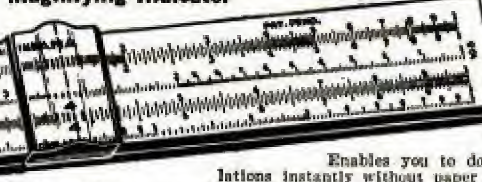
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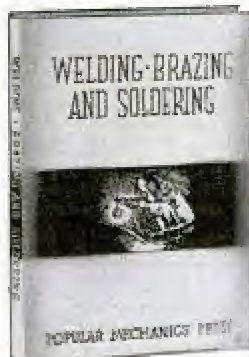
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